man. The complexion is pale and pasty but the hemoglobin is found to be 95% (Sahli). He walks with the aid of a cane. The neck is held stiffly and the right thumb is slightly swollen and its movement limited. Temperature 99°. Heart normal. I advised daily electric light baths and douches, Carlsbad salts, and a diet rich in fats and proteids.

June 23. Although the weather has been damp or rainy for a week there has been no return of pain or stiffness.

July 7. Feels perfectly well. He has taken twenty-two baths, and spends much time in the sunlight, as directed. He drinks from three pints to two quarts of milk daily with relish, and has gained eight pounds in weight. He had used a cane for a long time before beginning treatment, but discarded it about two weeks ago.

CASE V. *Insomnia of neurasthenia*. Mrs. K., aged forty-five years, seen with Dr. W. H. Howe, June 5, 1905. She had not been sleeping well for the past year. Last summer she spent several weeks camping out in the woods, but obtained no benefit. For the past four months she has had persistent insomnia and anorexia. She frequently does not fall into a sound sleep until five o'clock in the morning, and then awakes at seven. At the time Dr. Howe was first consulted she was taking a small amount of alcohol regularly before going to bed and a dose of trional about every other night. We advised daily treatments at the Medical Baths, consisting of an electric light bath and douches, for a month. Neutral baths at night were also prescribed. No hypnotics were used. She began to sleep well after the first week. She left for the country early in July and returned to town a month later in better condition than she had been for a long time.

CASE VI. *Severe neurasthenia of long duration*. Mrs. R., aged fifty-eight years, was sent to me by Dr. W. H. Baker in October, 1904. She stated that for twelve years she had been troubled with severe nervous prostration. She had tried all manner of treatment. At the time I first saw her she was unable to live with her family in Boston, because the stir of life in the city was unendurable. She complained chiefly of frequent attacks of faintness with a sinking sensation over the precordia. While I was obtaining the clinical history she became much agitated, and began to breathe deeply and heavily. Her face became flushed, and she complained that the room was very hot, although it was really uncomfortably cool. She begged to be led to an open window, and was fearful that she would faint.

I suggested that mild hydropathic treatments might be of value. She consented to try them, although she stated that in the past she had been unable to take even sun-baths. Very gentle procedures were employed. At first *Teilwaschungen*, later douches. It was found necessary to fan her constantly while in the electric light cabinet. Her condition improved greatly, and she is now able to live in town, and states that she feels like another woman. She still has very little nervous capital and continues to take treatments.

DESCRIPTION OF KILLIAN'S FRONTAL SINUS OPERATION.

BY E. E. FOSTER, M.D., NEW BEDFORD, MASS.

THE treatment of chronic frontal sinusitis may be considered under two heads: the intranasal, or the so-called conservative method, and the extranasal, or the radical procedure. The former comprises the removal of all irregularities causing an obstruction to free drainage from the frontal sinus: such as a deviated septum, an

enlarged middle turbinate, polypi, etc., and the irrigation of the sinus through the naso-frontal canal.

Rhinologists differ as to the results obtained by this procedure. Turner¹ is of the opinion that the number of cases cured must be very small, while Hajek² takes a more favorable view, which is shown by his report of the intranasal treatment of twenty-seven cases. Out of this number nine were cured, eleven had a slight muco-purulent secretion remaining, while only seven received no improvement in physical signs, although the headaches were stopped in all but three.

Ingals³ has recently advocated a method of enlarging and maintaining the patency of the naso-frontal canal, which adds to the possibilities of the intranasal treatment and deserves careful trial.

Schaffer's⁴ method of perforating the floor of the sinus between the middle turbinate and septum should never be undertaken.

The external ways of reaching the frontal sinus are numerous and can be most easily reviewed in a tabulated form. The first group includes those operations that permanently remove a part or the whole of the sinus wall.

1. Removal of the anterior wall.

(a) Entire anterior wall. Kuhnt.⁵

(b) Part or the whole of the anterior wall with enlargement of the naso-frontal canal. Ogston,⁶ Luc,⁷ Nebinger, Praun,⁸ Röpke,⁹ Coakley.¹⁰

2. Removal of the inferior wall. Jansen,¹¹ Richards.¹²

3. Removal of the anterior and inferior wall. Riedel.¹³

4. Removal of the anterior wall of the sinus and the frontal process of the superior maxilla. Hartmann.¹⁴

5. Removal of the anterior and inferior wall of the sinus, leaving a bridge, and the frontal process of the superior maxilla. Killian.¹⁵

The second group includes the operations that temporarily resect the anterior and inferior walls. Osteoplastic methods of Brieger,¹⁶ Czerny,¹⁷ Winckler,¹⁸ Barth,²⁰ Hajek,² Lothrop.²¹

The object of these operations is to leave the sinus intact or to obliterate it.

In a case of chronic purulent frontal sinusitis, in which intranasal treatment has failed to give relief, which of our present operative procedures is the best to permanently relieve the patient of his symptoms, with the least danger, deformity and time? Such an operation should, first of all, freely expose the sinus so that all parts can be examined and diseased areas completely removed.

2. It should include the removal of the anterior ethmoid cells, as these cells are nearly always associatedly diseased. Zuckerkandl²² states that he has never seen a case on the post-mortem table with disease of the frontal sinus, which did not show involvement of the ethmoid cells.

3. It should provide a large opening for drainage, preferably into the nasal cavity, after nature's example. This opening as Zarniko²³ says, "should not be like a narrow neck bottle but like a wide open bay."

4. It should be as free as possible from danger to life, produce little disfiguration and have a short after-treatment.

None of the operations presented will cover these demands so completely as Professor Killian's. His operation includes the best features of the other operations and in my opinion possesses the merits of as near a universal frontal sinus operation as has yet been conceived. It should be undertaken, however, only by persons possessing a thorough knowledge of the anatomy of this region, and with surgical ability.

The principals of the operation are the same as described by Killian in the *Archiv für Laryngologie*.¹⁵ As a result, however, of further experience he has been able to add much of value in the way of technique, which has improved, to quite an extent, the results of the operation, as his later cases show. These improvements in technique were reported by him at a meeting of the Vereins Süddeutscher Laryngologen in Heidelberg, June, 1904.²⁴ In our literature there are several brief outlines of this operation (Derby,²⁵ Freudenthal,²⁶ Canfield,²⁷ Harris²⁸), but each is based upon the original description and does not include the recent improvements, especially the resection of the floor of the sinus from below and the details for resecting the frontal process and diseased cells.

Zarniko's²³ description, which is the best that I have found in the German literature, is not wholly in accord with Killian's lately reported improvements.

I have seen the so-called Killian operation performed both here and in Europe, and I know the results would have been better in most instances had Killian's method been more thoroughly understood. It is with this in mind that I have prepared the following brief account of the operation as I have seen it done by both Professor Killian and his assistant, Docent von Eicken.

Up to June, 1904, they had operated upon 50 patients.

Killian considers as indications for his operation the following conditions:

1. When other operations have failed.
2. When there are indications of necrosis, as a fistula or abscess.
3. When there are symptoms of intracranial complications.
4. When in a case of chronic purulent frontal sinusitis pain and fever appear with a foul smelling discharge.
5. When there is headache, particularly when associated with discomfort in the region of the eye, which is not relieved by intranasal treatment.
6. When, in spite of oft repeated irrigations of the sinus, the discharge remains foul.
7. When the inflammation in the frontal sinus and anterior ethmoid cells produces recurring groups of polypi.
8. When a simple purulent discharge is not relieved by careful intranasal treatment, and the patient desires permanent relief by a radical procedure.

If possible, the outlines of the sinus should be determined by skiagraphy before any surgical interference is undertaken. In the hands of a skillful operator, skiagraphs can be made showing a clear outline of the sinus.

Scheier²⁹ states that skiagraphy will determine the presence or absence of the frontal sinus, the antero-posterior diameter, the height and the thickness of the anterior wall. Winckler¹⁹ even claims that he can determine the thickness of the floor and relations of the ethmoid cells.

A quarter of an hour before beginning the operation the patient is given subcutaneously $\frac{1}{2}$ grain (0.01) of morphine. Formerly the affected sinuses were then washed out and the nasal tampons put in place, but of late this is omitted, so as not to unnecessarily excite the patient. The patient is placed upon an operating table with the body raised. An anesthetic is administered. Killian uses chloroform. During, or immediately after, the anesthetization, the nasal cavity of the affected side is filled with four tampons made of cotton rolled into the shape of a small Perfectos cigar, with a thread fastened about the middle. The first one is firmly placed along the floor of the nose, between the inferior turbinate and septum; the second in the middle meatus; the third fills the olfactory cleft, and the last (which is an important one) is placed firmly in the forward part of the nose, beneath the bridge and between the frontal process of the maxillary bone and septum. This last tampon supports the mucous membrane covering the frontal process, thus preventing hemorrhage and injury during the resection of that bone. The mucous membrane thus saved forms the largest part of a flap to be described later. The first and second tampons are placed far back so as to completely close the choana. Killian never uses a post-nasal plug.

The field of operation is prepared in the usual way with soft-soap, alcohol and corrosive. Extra care should be used in cleaning the eyebrow as it is not shaved. In some of Killian's early cases, where the eyebrow had been shaved, the hairs grew very long or did not grow at all, producing in either case an unsightly appearance. He has experienced no infection as a result of leaving the eyebrow. The eye on the affected side is protected with a few layers of moist gauze, and the part of the head and body not included in the field of operation, should be carefully protected with sterile towels and sheets. Two assistants, an anesthetizer and a nurse are needed.

The surgeon stands on the side of the table corresponding to the affected sinus, facing the head of the patient. The first assistant and anesthetizer stand on the other side. The second assistant stands on an elevated platform at the head of the table. He steadies and moves the patient's head from time to time as the surgeon may wish. An electric head lamp should be at hand. The Kirstein lamp is the best. Reflected light can, of course, be used. This operation can be performed with chisels, bone forceps and the usual instruments of the ordinary surgical kit, but it is made much easier and more rapid by

using Killian's straight and curved V-shaped chisels (Fig. 1) and eye protector (Fig. 2), Hartmann's or Gründwald's cutting forceps and Lombard's or Jansen's bone forceps. A medium-sized straight sound should be included in the list of instruments.

The initial preparations being completed, the actual operation is commenced. Killian makes three distinct incisions: The first through the

FIG. 1. — Killian's straight and curved V-shaped chisels.

skin, the second through the subcutaneous tissues to the periosteum, and the third through the periosteum. The neatness and care used in making the first and third incisions has much to do with the cosmetic result. The first one begins at

FIG. 2. — Killian's protector.

the temporal end of the eyebrow, extends inward through its middle to the nasal end, where it passes downward in a graceful curve along the root and side of the nose to and a little below, the base of the nasal bone. (Fig. 3.) During the

operation the two edges of the wound are considerably stretched and difficult to accurately oppose when ready to suture. A bad approximation would produce more or less disfiguration. Killian overcomes this by making, at regular intervals, four or five short superficial incisions at right angles to the long one just described. (Fig. 3.) While cutting through the subcutaneous tissues above the eye, it is advisable to protect it and the supra-orbital margin, and to steady the tissues, by carrying a finger of the left hand beneath the supra-orbital margin with the progression of the knife. The hemorrhage is arrested with pressure and light clamps, which are left hanging. If the gauze pad protecting the eye has been soiled or pushed out of its place, which is usually the case during the above procedure, it must be replaced so that the clamps

FIG. 3. — The long and transverse skin incisions.

and instruments will not injure the eye. The edges of the wound are now slightly separated with retractors and the incisions made through the periosteum. The first begins at the temporal end of the original incision, extends inward 6 to 8 mm. above and parallel to the supra-orbital margin, to the upper end of the nasal bones. (Fig. 4.) The second begins one quarter of an inch internal to the supraorbital notch, extends inward on the orbital margin until it intersects the nasal portion of the skin incision, which it follows to its lower end. (Fig. 4.) Formerly, the first part of this incision was made only 5 to 6 mm. above the supra-orbital margin, and the groove was marked off a little way above, leaving a part of the supra-orbital bridge uncovered with periosteum. Now the bridge is completely covered, as will be explained later. The periosteum covering the anterior wall of the frontal sinus is elevated and retracted. If the outlines of the frontal sinus have been determined by skiagraphy the groove, forming the upper margin of the supra-orbital bridge, can be made; otherwise an opening must be made into the sinus for the purpose of finding out, with a probe, its size and shape. This

opening can be made either above the supra-orbital bridge, to be formed, or just below it, at the root of the nasal bone. (Fig. 4.) The latter is the safer place. According to Mosher³⁰ the sinus in one third of the cases is just within the rim of the

FIG. 4.—The heavy lines represent the first and second periosteal incisions. The lighter curved line outlines the area of bone to be removed for the purpose of probing the sinus.

orbit at its superior internal angle. The opening should be made through the bone with a chisel, exposing but not perforating the underlying mucous membrane. A probe can then be passed between the bone and the mucous membrane outward, upward and inward, giving an approximate size of the anterior wall of the sinus. The temporal end of the sinus is marked off and a groove made from this point, extending inward nearly to the median line close to or a little below the edge of the periosteum covering the supra-orbital ridge, that is: 5 to 7 mm. above the supra-orbital margin, the object being to leave the bridge completely covered with periosteum. (Fig. 5.) This groove can be made quicker and better with a straight V-shaped chisel (Killian) although an ordinary flat chisel can be used. The lower surface of this groove forms the upper edge of the supra-orbital bridge, consequently it should be smoothly and evenly made. After the groove has been made deep enough to enter the sinus, all of the anterior wall of the sinus lying above can be removed with Lombard's, Jansen's or an ordinary bone forceps and chisel. Care should be used not to break the bridge during the resection. When the anterior wall has been completely removed, the mucous membrane and any partial bony septa must be carefully and completely erased, special attention being given to nooks, corners and the posterior surface of the supra-orbital bridge. All sharp corners, grooves or depressions must be obliterated by beveling off the surrounding elevated bone, thus leaving a smooth surface where pus cannot be retained.

This completes the work above the bridge. The sinus is loosely filled with gauze and the retracted tissues allowed to assume their normal position.

Our attention is now given to the resection of the frontal process of the superior maxillary bone. The periosteum is elevated and retracted from the nasal bone, frontal process, lachrymal groove and orbital portion of the frontal bone, toward, but not to, the supra-orbital notch. Killian's small-sized, bent, V-shaped chisel is placed at the lower end of the suture, between the nasal bone and the frontal process of the maxillary bone, and driven upward with a mallet along this suture, forming a groove as it goes. This groove is extended from the upper end of the suture into the frontal bone, toward, but not to, a point midway between the supra-orbital notch and the attachment of the trochlea, thus forming the lower edge of the supra-orbital bridge. The chisel is again placed at the lower end of the suture, as above, but this time it is driven at right angles to the suture, that is, through the frontal process toward the lachrymal bone, care being used not to injure the lachrymal sac (*vid. Coffin's case*³¹). This groove prevents the downward breaking of the frontal process during its resection. (Fig. 5.) The resection can be best accomplished by starting at the lowest portion of the frontal process to be removed. This is just above the last made groove. Here the bone is thinnest and can be easily perforated without injuring the underlying mucous membrane, which must be

FIG. 5.—Grooves made with the V-shaped chisels to form the upper surface of the bridge and to outline the portion of the frontal process of the maxillary bone to be removed.

preserved for use as a flap. After a small opening through the bone has been made, bone forceps will very quickly remove the largest part of the process, but at the upper end a chisel may be needed. The resection is extended a little way above the frontal process including a small part of the frontal bone, which is a part of the sinus floor.

The removal of this bony area gives us free access to the floor of the sinus and the nasal cavity. The periosteum is now elevated from the remaining lachrymal bone and groove, from the orbital portion of the ethmoid bone posteriorly to the anterior ethmoidal vessels, and from the orbital portion of the frontal bone lying inward and downward to the trochlea attachment and supra-orbital notch. In other words, the limits for elevation and resection are: The lower part of the lachrymal groove below; the anterior ethmoidal vessels behind; and the trochlea attachment and supra-orbital notch above. The elevation is very easily done with Killian's protector. The orbital tissues are then retracted outward with the protector, and held in place by the first assistant. This gives a good view of the operative field, and makes a space in which to remove the remaining sinus floor, part of the ethmoid plate and lachrymal bone, the erosion of as many of the ethmoid cells as is found necessary, and even the opening of the sphenoid cell, if it is diseased. There is no way of so accurately and safely operating upon the ethmoid and sphenoid cells as through an opening made by the resection of the frontal process of the maxillary bone. The tampon in the forward part of the nose and the one in the olfactory cleft are now removed, the above mentioned bones resected, and the diseased cells obliterated. This is best accomplished with Gründwald's, Hartmann's, or a similar cutting forceps and curettes, under the guidance of good artificial light. Any part of the frontal sinus floor or wall that cannot be reached from below, can be from above. Formerly Killian removed the whole of the floor of the sinus from above, but at the present time does not, except for reasons just stated.

In doing this resection the limitations must be kept in mind, that is, the lower part of the lachrymal groove below, the anterior ethmoidal vessels behind, and the trochlea attachment and supra-orbital notch above. When it is necessary to destroy ethmoidal cells posterior to the anterior ethmoidal vessels, it must be done internal to the remaining orbital plate of the ethmoid bone. After the above resection has been completed, we have a large opening from the frontal sinus into the nose, with the supra-orbital bridge in front. (Fig. 6.) The surface of the whole bony field must be made perfectly smooth. The operation is completed by making a flap of the uninjured mucous membrane that covered the resected part of the frontal process of the maxillary bone, and any adjoining healthy mucous membrane. This is done by perforating, with a sharp-pointed knife, the mucous membrane at the lower edge of the nasal bone, and by means of a probe-pointed knife the incision is continued upward along the edge of the nasal bone to within $\frac{1}{2}$ cm. of the cribiform plate, where it extends backward as far as there is good mucous membrane to be used, then downward. This flap is pushed outward against the adjoining orbital tissues. If the middle turbinate has not been removed, and its mucous membrane is not degenerated, an extra

flap can be obtained by removing the forward part of the bony structure of the turbinate. This can be easily done by steadying the turbinate with a medium-sized sound in the olfactory cleft, while the bone is being removed with curette or forceps, passed through the opening made by removal of the frontal process. If the nasal mucous membrane is degenerated, the formation of a flap may be omitted.

The wound is cleaned with normal salt solution and dried. The whole area should be carefully examined for projections, nooks and corners that could in any way prevent perfect drainage. Iodoform is blown into the wound. The two remaining tampons in the nasal cavity are removed. A narrow strip of iodoform gauze is loosely placed in the region of the ethmoid cells, an end of which hangs out of the nasal orifice. In placing this

FIG. 6.

gauze see that the mucous flap is in its proper position. The remaining part of the nasal cavity is filled with cotton tampons. The tampons and gauze are removed on the second day not to be renewed, as the opening from sinus into nose is so large that all secretion will easily flow out.

In cases where the septum is deviated to the affected side and would make the opening from the sinus into the nose too narrow for good drainage, it should be straightened by the submucous resection method before undertaking the sinus operation. If Killian's³² submucous method is used the delay will be only for three or four days. The skin in the field of operation is cleaned and the wound edges are immediately sewed together with aluminum-bronze wire, when none of the following contra-indications exist: Acute process, whether it be primary or an exacerbation of a previous attack; when there is a question of an intracranial suppuration; when the pus is foul or there exists a decided necrotic process. In all of these conditions the secretion is virulent and

ought not to be inclosed in the sutured wound. The wound can be, however, safely sutured on the second or third day. Killian has immediately sutured twenty-four cases out of thirty-one, or about 80%. Great care must be used in accurately approximating the two wound surfaces. This, however, is easily done if the short superficial incisions were made at the beginning of the operation. (Fig. 3.) When the wound is not united at the end of the operation, the two surfaces are slightly separated by a gauze drain. Before applying the dressing a drop of a 1% solution of atropin is instilled into the eye. The eye is covered loosely with gauze and a good-sized dressing of moist boric acid gauze placed over all. The patient is put in bed upon the sound side, and made to lie in this position most of the time for a few days. He is forbidden to blow his nose, and told to draw into the throat all wound and nose secretion, which can be expectorated. The dressing is removed every day. The nasal tampons and gauze packing are removed on the second day. On the fourth or fifth day the sutures can be removed. A day or so later the eye is left uncovered when applying the dressing, and shortly the dressing is omitted entirely. This, of course, applies to those cases where primary union takes place. The nasal cavity is not flushed out, nor is there much intranasal treatment. At the end of the third or fourth week the wound cavity, lying above the mucous covered nasal cavity, is painted with a 2½% solution of nitrate of silver, care being used not to touch the mucous membrane of the nasal cavity.

Luc,³³ who has adopted this method of operating on the frontal sinus, pays considerable attention to the after-treatment. He removes the crusts daily and carries upward into the cavity a tampon of wool soaked in peroxide of hydrogen, or a weak solution of iodine. The amount of depression above the supra-orbital bridge depends upon the size and depth of the sinus. Fortunately, however, depressions of almost any size can be filled in with the proper use of paraffin. When the maxillary sinus is associatedly diseased, it should be first operated upon, and after tightly packing, the frontal sinus attended to. As stated above, all the diseased ethmoidal cells and sphenoid cell can be most easily removed through the opening made by the removal of the frontal process of the superior maxillary bone. Killian has operated seven times upon all the accessory sinuses of one side with good results. If both sides are diseased, only one side at a time should be attended to, the other side being left until the operated side is healed. Killian says that patients willingly return for the second operation being so well pleased with the results of the first.

During my stay in Freiburg I saw this operation performed eight times and had the opportunity to observe four other patients on whom the operation had recently been done. The relief of symptoms was perfectly satisfactory. The disfigurement varied in accordance with the size and shape of the sinus, but after the use of paraffin

the cosmetic results were all that could be desired. There was no deformity below the bridge. The convalescence was of short duration, with very little after-treatment. Iritis did not occur, neither did I see permanent diplopia.

In a series of eighty cases, published and unpublished, that I have been able to collect, only two deaths occurred, making a mortality of only 2½%. The cases collected by Turner¹ show 87% of cures for the Killian operation as against 58% for the Ogston-Luc. I am confident that this percentage of cures as a result of the Killian operation will be markedly increased and the mortality decreased after the operation is better understood and carried out.

In December, 1904, I assisted Dr. Owen Smith of Portland, Me., in performing this operation on a woman seventy-six years of age, who had been suffering for a long time with chronic purulent frontal sinusitis.

The accompanying photograph (Fig. 7) was made of this patient at the time of her discharge from the hospital, three weeks after the operation.

FIG. 7.—Three weeks after a Killian operation on the left frontal sinus.

The eyebrow was shaved, as we were not obliged to consider personal appearance, so the supra-orbital scar is more noticeable than it would otherwise have been. The convalescence was free from complications. Practically no pus appeared after the removal of the tampons and ethmoidal packing. No after-treatment.

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A STUDY OF THE LARYNX IN TABES.*

BY D. CROSBY GREENE, JR., M.D., BOSTON.

THE subject of laryngeal disturbances in tabes has been investigated by many observers. The most valuable work is an elaborate monograph on the subject published in 1903 by H. Dorendorf, of Berlin, in which there is a complete résumé of the literature to date, and a detailed report and study of laryngeal manifestations found in the course of the examination of 245 cases of tabes in Gerhardt's clinic in Berlin. I have referred to this work frequently.

My purpose here is to report the result of recent examinations made at the Massachusetts General Hospital, the Massachusetts State Hospital at Tewksbury, and at the Long Island Hospital, in sixty cases of tabes.

These were observed with reference,

- (1) To the proportionate number affected with paralytic and other disturbances of the larynx.
- (2) To the nature of such disturbances, and
- (3) To the period of their occurrence in the course of the disease.

(1) Out of the 60 cases examined, 9, or 15%, presented laryngeal complications; 6, or 10%, showed undoubted paralysis of one or both vocal cords; 7, or 12%, were affected with laryngeal crises, 3 of these without evident paralysis of either cord; and one presented a jerky movement of the cord in moving from the median line. Dorendorf found paralysis in 12%, and crises in 3% of his cases, while 4% showed the jerky movement of the cords which has been called ataxic, a much larger proportion than I found.

(2) In regard to the nature of these disturbances, the only form of paralysis which I saw was abductor paralysis. Of the 6 cases, 5 were unilateral and one was bilateral. These were further divided into 3 with partial and 3 with complete abductor paralysis, that is to say, in the former there was marked limitation in the outward excursion of the cord and in the latter there was absolute fixation of the cord in the median position.

* Read at a meeting of the New England Otological and Laryngological Society, Nov. 17, 1905.

In partial paralysis the cord at rest is approximately in the cadaveric position. It moves to the median position in phonation, but does not move outward beyond the cadaveric position in respiration. It is not warrantable to make the diagnosis in this stage without repeated examinations at intervals, on account of the variation in the excursion of the vocal cords which may be noted in normal individuals. In this connection I will mention one source of error in making the diagnosis of partial paralysis, pointed out to me by Dr. Coolidge, which lies in an asymmetrical position of the larynx not infrequently met with. The larynx being tilted to one side or the other there may be a difference in the degree of movements of the two cords as seen by the laryngoscope which is apparent rather than real.

In complete abductor paralysis there is no difficulty in diagnosis. The cord remains constantly in the median line. At the same time the arytenoid on the affected side is tilted forward depressing the processus vocalis so that the cord appears shortened and at a slightly lower plane than its fellow. There is also some bowing of the free edge of the cord. The change from the condition of partial to that of complete paralysis has been observed by Dorendorf in a few cases.

It is a remarkable fact that in this disease the paralysis should limit itself in the great majority of cases to the posterior crico-arytenoid muscle, while all the other intrinsic muscles which are supplied by the recurrent nerve, with the exception of the thyro-arytenoid internus are apparently unaffected. Grabower showed conclusively in a number of cases which were autopsied that there was a degeneration in the motor fibers of the vagus which supply the recurrent laryngeal nerve, but he found that it affected not only those fibers which supply the posterior crico-arytenoid, but also those supplying the other intrinsic muscles of the larynx. Recently he has further shown, by actually counting the number of fibers which go to the different groups of laryngeal muscles, that the posticus is supplied with much fewer nerve fibers than the other groups.

The explanation of the apparent restriction of the paralysis to the abductor muscles seems then to be that we are here dealing with a slowly progressive degeneration of the fibers of the recurrent laryngeal nerve. The abductors being the weaker group, especially as regards nerve supply, and hence having a proclivity to paralysis which was first demonstrated by Semon, are the first to succumb.

The vocal cord becomes drawn to the median line at first by the contraction of the adductors, and later by actual shortening of these muscles from atrophy. When the degeneration in the recurrent nerve progresses rapidly complete recurrent paralysis is to be expected, and this condition has been reported in some cases of tabes by Semon, Dorendorf and others, although I did not find one case.

Laryngeal crises occurred as a symptom of tabes in conjunction with abductor paralysis