Tuberculosis of the larynx

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TUBERCULOSIS OF THE LARYNX

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Tuberculosis in its various and protean manifestations has occupied a prominent place in the minds of medical men, as well as those of the laity who are interested in public health, for more than a score of years past. The particular type of tuberculosis that has been receiving the most attention from the eye, ear, nose and throat specialists in this time, is tuberculosis of the larynx. This is due to its common occurrence, to the intense desire to alleviate the conditions imposed by the disease, and to its influence on the prognosis of pulmonary tuberculosis. This is always rendered more grave by the presence of laryngeal tuberculosis.

It shall be the purpose of this paper to consider first, the different aspects of the disease itself; second, to review the various modes of treatment with reported results; and third, to give the results of the treatment followed at the Iowa Clinic.

Definition.

Laryngeal tuberculosis is a specific infection caused by the tubercle bacillus, presenting in the same form the conditions produced by it anywhere in the body, that is, inflammation, infiltration, tubercle formation, fibrosis or caseation and ulceration. Levy (1) has defined three stages of tuberculosis of the larynx:

First, anemia, or hyperaemia with slight infiltration.
Second, extensive infiltration.
Third, ulceration and necrosis.
Etiology.

Laryngeal tuberculosis is caused by the presence of the tubercle bacillus in the tissue of the larynx. The tumefactions of the larynx were spoken of as "tubercle" before the discovery of Koch's bacillus, but now the true tubercle is recognized as due to the presence of this organism.

It exists in a percentage of cases of pulmonary tuberculosis, the exact percentage being in a measure determined by the accuracy and persistency of examination. Osler (2) gives eighteen to thirty per cent. Willigk (3) estimates the percentage at thirteen percent. Shaeffer (3) estimates ninety-seven per cent. Dennis (4), Briggs (5) state that a routine examination of the larynges of all tuberculous patients would reveal many unsuspected cases. Schroeder (6) estimates that twenty per cent of all chronic pulmonary tuberculosis cases have laryngeal complications. The same author may vary, as Levy (1) shows in the case of StClair Thomson (7) stating that post mortem findings prove laryngeal tuberculosis present in fifty per cent of those dying from pulmonary tuberculosis, and in a later report (7) based on the study of 693 sanitorium cases finding 25.6 per cent having the complications.

From the statistics of the Oakdale sanitorium (9), it is learned that in the life of this institution, eight years and nine months up to April 1, 1915, in a total of 1912 cases admitted, there was present or developed during
the residence of the patient, a total of only 202 cases. This percentage, 10.6 per cent, is lower than most statistics given. However, it must be noted that in the first four years of this period—for what reason no opinion is advanced—out of 611 cases only 7 cases were diagnosed. This leaves in the next five years, in 1301 cases a total of 196 cases of laryngeal involvement, or 15.06 per cent.

During the four years, 1910-1914, 111 cases of simple chronic laryngitis were diagnosed. Conditions which obtain at the Iowa State Sanatorium for the treatment of Tuberculosis would account for this large number, that is, the patients do not remain here long enough to have the diagnosis changed, as the condition passed from the non-tuberculous appearance to the true tuberculous laryngitis. It must not be forgotten, however, that there are many cases of non-tuberculous laryngitis in tuberculous subjects.

On one point laryngologists and tuberculosis specialists seem to be nearly unanimous, that is that the percentage of the frequency of occurrence increases as the lung condition becomes more advanced, decreasing again as the Tuban III, National Committee III, cases are studied. Levy's (1) statistics here are of interest. Out of 338 cases 83 in the first stage had laryngeal involvement, 170 in the second stage, and 85 in the third stage. He observes however, that the assumption that
Laryngeal trouble is relatively more rare in the first stage, will account for its being overlooked. Then, as above suggested, cases diagnosed as simple laryngitis may pass out from under observation before the diagnosis is changed to tuberculous laryngitis. The laryngologist knows that when he is in doubt it is better to give the simple diagnosis because of the graver prognosis especially in the mind of the patient. At Oakdale the diagnosis of simple chronic laryngitis is made, but the treatment of tubercular laryngitis is, in part at least, prescribed simply to conserve the patient's hopeful outlook. Lamberson (10), in a study of 244 cases of pulmonary tuberculosis, gives 45 per cent as having tuberculous laryngitis, and 21 per cent having non-tuberculous laryngitis. His high percentage of simple laryngitis might be explained on the above supposition.

It occurs more frequently in men, 71 per cent, than in women, 29 per cent, according to Wright and Smith (11). In the Oakdale cases, however, we find them nearly equal, 102 males and 100 females. It is rare in children and in old age. The majority of the cases develop from the age of 20 to that of 40.

The exact mode of infection of the larynx is not a settled question. Whether from without, primary, or from within, secondary, is a point around which a vast amount of work has been done. Does laryngeal tuberculosis exist as a primary infection? Or, is it always depend-
ent upon a lesion elsewhere in the body which is discharging bacilli?

It is probable that primary laryngeal tuberculosis does exist though exceeding rare. Shurly (12) says that in a large experience he has never seen a case. Kyle (13) says that based upon theoretical ground and postmortem examination it must exist, though rarely. Steiner (14), Assistant at Laryngolischer Universitats Institut in Prag, says in very rare cases primary laryngeal tuberculosis does exist. Many authors, VonZiemsen, Klebs, Eppinger, Morell MacKenzie, Watson-Williams, Grant, and many others state that all laryngeal tuberculosis is secondary and can be proved to be such if careful enough post mortem examinations are made.

Steiner (14) reports a case of his wherein undoubted laryngeal tuberculosis existed. Careful clinical examination failed to show any lesion. The patient suddenly developed a stenosis and before tracheotomy could be done died. Most careful post mortem examination, macroscopic and microscopic, failed to find any focus from which tubercle bacilli might have emanated to cause laryngeal tuberculosis. A small calcified lymph node in each bronchial hilus was the only possible source. Such other local foci as existed, as for example, in the tonsil, were histologically younger than the laryngeal lesion. Steiner maintains that no open focus, and hence no possible source for the infection of the larynx existed.
Orth, Demme, Farankel, Progebinsky, Manasse, and Steiner, have each reported one case of primary tuberculosis where post mortem findings have substantiated the clinical diagnosis. Theoretically it is conceivable that it can occur. But if Hamburger's dictum be accepted, that over 94 percent of all adults have a focus of tuberculosis somewhere in the body, it must be conceded that the proof of an infection taking place in the larynx from without, in those decades when laryngeal tuberculosis exists, against all the barriers of immunity, and the natural mechanical obstacles to lodgment and growth in the larynx, is one proof that would be extremely difficult to make.

Laryngeal tuberculosis secondary to foci elsewhere in the body is then the rule. How does this infection in the larynx take place? Laryngeal tuberculosis is most frequently co-existent with or complicates pulmonary tuberculosis. Unfortunately, in a majority of the cases it is a late complication coming when the tubercle bacilli can be readily demonstrated in the sputum. In such cases it is easily seen how the sputum is carried up by the ciliated epithelium until it reaches the larynx, there to remain for more or less of time, because the epithelium of the glottis is pavement, until coughed out. At night especially, does the sputum accumulate in the larynx. The epithelium of the mucosa becomes weakened, perhaps injured by the force of coughing, and the tubercle bacilli penetrate it. Wright and Smith (11) report a case with hyperplastic epithelium
in which the tubercle bacilli were caught and stained while passing through the epithelium.

Undoubtedly the bacilli are often carried here by the blood and lymph streams since bacteremia has been proved in systemic tuberculosis. The presence of many tubercle bacilli in the lymph stream is shown inferentially by the large number of caseated lymph nodes in tuberculous subjects. The transmission of tubercle bacilli by the blood is now known to be one of the most important if not the most important means of disseminating infection in the body. Experimental evidence goes to prove quite conclusively(11) that pulmonary tuberculosis results from the implantation of tubercle bacilli brought there by the blood from the alimentary tract, and not from the air-borne tubercle bacilli.

Pathology.

Macroscopically the pathology varies greatly. Early hyperaemia and edema of the arytenoids and cords are common. On the other hand, Kyle and many others regard anemia as being present early. Infiltration with round cells always comes early, and if this impinges on the blood vessels, as it does, constricting them against the hard cartilage, either anemia or edema may occur, depending on whether arteries or veins are constricted. On the other hand there is a thickening of the epithelium on the posterior surface of the larynx that at first may give an anemic appearance.
The formation of small diffuse tubercles that later fuse forming the large tuberculoma, may occur next. These usually begin in the interarytenoid space, and present a reddish, nodular mass filling the space more or less completely. According to Casselberry (15) the most diagnostic site for these tumors is in the "vocal angle", that is, the posterior end of the true cord, on the arytenoid and encroaching on the interarytenoid space. These tubercles show a tendency to break down at the apices forming ulcers. Ulcers may form when there is no visible tubercle formation. They tend to spread superficially forming large, shallow areas, which are covered by a mucopurulent secretion of secondary infection. These may spread until the cords are eroded, and from thence cover the entire surface of the larynx, epiglottis, pillars of the fauces, pharynx, and nasopharynx, even extending up on the soft palate, as in a case seen by the writer in the Woodmen Sanatorium at Woodmen, Colorado. A similar case has recently appeared at the Iowa Clinic. Thiesen (16) makes a point of the existence of a true hypertrophic form of tuberculosis in which the tumors do not show any tendency at all to ulcerate. This he regards as a distinct type of laryngeal tuberculosis.

Bar (17) of Nice favors the division of the macroscopic pathology into two divisions as suggested by Krause:

First, infiltrating, ulcerating forms;

Second, Slow evolving, hypertrophic forms that show no tendency to ulcerate.
Symptoms and Signs.

Laryngologists seem to be well agreed that there are no distinctly pathognomonic symptoms of tuberculosis of the larynx. From the authors read one concluded that the more extensive the experience of the writer, the fewer positive symptoms does he describe. The early symptoms are usually those of simple laryngitis, tickling in the throat, feeling of dryness, and slight huskiness. Osler (2) states that the huskiness is peculiar and suggestive. As the process goes on there is a cough of a "huskyineffectual type". Briggs(5) says that this huskiness develops into hoarseness, and may go on to complete aphonia. It is well to remember as May suggests that the hoarseness may be due to a paresis of the superior laryngeal caused by pressure of tuberculous glands, the larynx itself being uninvolved. Such a case as this was operated upon by Dean in 1914. With the development of tuberculomata in the larynx dyspnoea may supervene, though not common.

In the ulcerative stages pain becomes more prominent. Dennis(4) gives pain "spontaneous or on swallowing, shooting up into the ears" as quite characteristic. With the ulceration of the epiglottis the dysphagia becomes very severe, troublesome, and often agonizing. So severe is it in fact, as to cause general weakening and loss of resistance through starvation. Swallowing of fluids is often more painful than the swallowing of solids. If the ulceration involves blood vessels hemoptysis may ensue, as
in Case 2 reported in this paper. The tuberculin test may be of value in securing a focal reaction. It should not be forgotten, however, that carcinoma of the larynx has been reported as giving a positive reaction to tuberculin (Kenyon 18).

Examination of the larynx shows early a condition of simple chronic laryngitis, that is, a hyperemia of the mucosa of the cords and interarytenoid space. Collins of the Denver National Jewish Sanatorium, says that to the above signs a slight infiltration may be added. A little later edema appears in the cords and tips of the arytenoids. Soon there appear small smooth excresences on the surface of the edematous mucosa, particularly in the interarytenoid space.

In chronic cases anemia may be present instead of hyperaemia and was formerly considered a typical condition. Dennis (4) regards the pallor of the mucous membrane as a very unreliable sign. He gives a condition which he regards as very constant and reliable, "a thin line of mucoputis in the posterior commissure, extending up from below into the interarytenoid space". The small tubercles, especially in the interarytenoid, soon fuse to form larger tuberculomata, which, as Cassellbury (15) points out, assume a mammilated appearance. Ulceration, superficial, ill defined and ragged, supervenes and usually spreads, involving cords, arytenoid cartilages, up into the sides of the larynx, involving the base, and later the entire epiglottis. Although as a rule this ulceration is super-
ficial, in some cases the entire epiglottis is eroded away. At other times this organ becomes thickened and edematous, assuming the so-called turban shape.

On phonation the cords seem to be sluggish in movement, due to the edema, infiltration, erosion and stiffening at their arytenoid attachment.

In briefly summarizing the appearance of a tuberculous larynx it must be remembered that the picture is not always clear cut. For example, if tumors are seen in the inter-arytenoid space they may be an epithelioma or carcinoma. Kenyon (18) states that in a case of suspected tuberculosis of the larynx the tuberculin test was given with a positive reaction in the larynx and also a general reaction. Tuberculosis of the larynx was diagnosed. Four years later a laryngectomy was done for an epithelioma.

The appearance of syphilis of the larynx is often confusing. The tumor formations are much alike, but differ in the site of election. Syphiloma are as a rule sub-glottic while tuberculomata are interarytenoid in position. Going still farther we find Moritz Schmidt (4) reporting a case in which all three conditions, carcinoma, tuberculosis, and syphilis, were present at post mortem though the clinical appearance of the larynx led to a diagnosis of tuberculosis of the larynx.

Diagnosis.

The diagnosis of a case of tuberculosis of the larynx is at times easy, at times impossible without repeated examinations. The large preponderance of secondary cases
would of itself be a great aid in the diagnosis, especially since as a rule tuberculosis of the larynx does not appear until lung involvement is easily detectable clinically.

Bearing in mind the chief symptoms; dryness, tickling in the throat, a voice that tires easily, may be diphonic, slight huskiness progressing to aphonia, dysphagia, a wracking but ineffectual cough; and finding a number of these symptoms present in a case of pulmonary tuberculosis, a pretty clear history is presented. A laryngoscopic examination for the signs given above would tend to confirm a diagnosis.

In tuberculosis of the larynx time is often the essential factor in diagnosis. In the clinic here many cases coming from the sanatorium are at first not diagnosed, or if so, are diagnosed as chronic laryngitis. In a few weeks with the appearance of a unilateral infiltration extending from either arytenoid downward and outward into the subglottic space, or a tumor in the interarytenoid space, the significant edema, or characteristic shallow ulceration at the anterior or posterior end of the cords, the cases are now diagnosed as tuberculous laryngitis.

The great facility with which a small piece may be excised for microscopical examination makes the differential diagnosis much easier now than formerly. One runs a risk, however, in excising a piece if it proves to be a malignancy. The incision of a malignant neoplasm will, as is well known, often be sufficient to cause rapid
exacerbation of the growth, and the formation of metastases.

Between syphilis and tuberculosis of the larynx a pathological-histological examination is not always conclusive. Pathologists of considerable experience are known to say that in and of itself a microscopic examination is only a link in proof of the type of lesion. A competent eastern pathologist has made the statement that he never feels easy when he has to differentiate between tuberculosis and syphilis of the larynx microscopically. A recent case in the clinic here will illustrate this. A man aged 56 came to the clinic complaining of hoarseness and dysphagia. On examination he presented a punched out ulcer of the right soft palate, extending down the pharynx into the larynx, involving the false cords. A tentative diagnosis of syphilis was made. Blood was taken for a Wassermann, and a piece excised from the palate for histological examination. The pathological report came back "syphilis but no spirochaetes can be demonstrated". The Wassermann was negative. The patient left, offended because of the diagnosis. Four months later he came to the Oakdale sanatorium and was immediately sent to the laryngologist to have his throat treated and a diagnosis made before they would admit him to the sanatorium. He came to the clinic again and the clinical diagnosis was again syphilis, another piece excised and pathological report asked for. Looking up the former report a section was stained for tubercle bacilli, a point inadvertently omitted before,
and tubercle bacilli were found in great numbers.

Another case may be cited. A young woman of thirty-four came into the office with hoarseness of a few months standing. Examination showed the vocal cords to be infiltrated and the right vocal cord almost immovable on adduction. There was tumefaction of the false vocal cords. The arytenoids were swollen and edematous, a larynx very suggestive of tuberculosis. Examination of her lungs by a specialist gave no active tuberculosis. A piece was excised from the false vocal cord for microscopical examination, and blood taken for a Wassermann. No tubercle bacilli could be demonstrated in the tissue. Histologically it showed simple chronic inflammation, no tubercles or anything suggesting either tuberculosis or leues. The Wassermann came back double plus. Active antisyphilitic treatment was begun at once and the lesion improved rapidly both subjectively and objectively. At the present time, May 20, 1915, her voice is much improved, the hoarseness being practically absent. The left cord is nearly normal, but the right is still infiltrated. She has received her first injection of salvarsan and is improving under the use of mercury and iodides.

Prognosis.

The development of tuberculosis of the larynx, without any question renders the final outcome of the disease process less hopeful. This is true, not only because
of the added lesion which the body as a fighting unit has to resist, but it is an added evidence, in early cases, of either a lack of resistance or of a very virulent type of infection. In the average case it is an evidence that the disease is progressing, that the bodily defences are being broken down, in other words, the disease has reached an advanced stage.

Not so many years ago the development of a laryngeal complication was considered as a notice to the physician and the patient that further attempts at resistance were useless; and so the whole efforts were directed thence forward to making the last days of the patient as comfortable as possible. With the advances made in the past fifteen years in the treatment of this complication this gloomy outlook no longer obtains, although it must not be forgotten that it is very grave. The rapidly spreading, ulcerative type, developing in patients with advanced lung involvement is still regarded as most fatal. Osler (2) states that the "prognosis is especially bad where tuberculous laryngitis develops in cases where one apex only is involved". Bonney (19) states "it should be borne in mind that in some cases the laryngeal involvement may be devoid of any clinical significance", but he also states that in other cases "the laryngeal disturbance assumes a prominence sufficient to overshadow all other considerations". Levy (1) states that the significance of throat lesions "is a matter of vital importance" in pulmonary tuberculosis. Brown (20) says that "of the complications, tubercu-
loss of the larynx ------- is of especially evil import". Doctor Phillip is quoted by Doctor Dean (21) as saying that "tuberculosis involving the vocal cords, false cords, epiglottis, or the arytenoids, is always fatal". Doctor Dean himself states that "eight or ten years ago it would have been considered dishonest to hold out hope of recovery to the relatives of a patient with laryngeal tuberculosis. Bourack (22) says "twenty five years ago it was taught that laryngeal tuberculosis was incurable.

Turning now to the lesion itself, what is the prognosis relative to a favorable outcome? Here the same conditions prevailed, the most that physicians could hope to do a decade or so ago was to relieve pain and hope for euthanasia. Contrasted to this we now find a very different attitude among laryngologists and tuberculosis specialists. All admit that the situation demands careful conservative judgment and united action on the part of physicians and patient, but the records show that a gradually growing and gratifying percentage of cases do recover, and well authenticated cases of permanent cures are many. So well known a specialist as Doctor Pottenger (23) states that he has been "very much gratified with the treating of the larynx," and that "this method of treatment makes the prognosis in tuberculosis of the larynx practically the same as that of the lungs". Another specialist applies the word "brilliant" to the results obtained in the treatment of the local lesion. A definite prognosis is, however, very
hard to make. So many outside factors enter in. Briefly it seems to the writer that the prognosis depends to a much larger extent on the patient's mental equipment than it does on any other single factor. His determination and perseverance in carrying out the course of treatment prescribed will certainly do more to bring a good result than any one method of treatment if he will not cooperate. The best results in the cases at the Iowa clinic have been obtained in those patients who have been most conscientious in carrying out their part of the outlined course of treatment.

A record of cases at the state Sanatorium extending back over the past twenty two months will show that of sixty four cases that have been treated, thirty six (56%) have improved. Eighteen (28%) have been cured, and only ten (16%) have been unimproved. This high percentage of good results is in large measure due to the careful supervision of the patients. Allowing the personal element to enter in we find that those who have had cures are the ones that have been most persistent in their efforts.

In making the statements regarding prognosis it is assumed that an early diagnosis is presupposed. This is essential to the most favorable prognosis. Other factors enter in, the coexistence of other complications, nasal pathology, constitutional diseases, syphilis, nephritis, etc., the progress of the lung condition, the stage of the lung condition at the time of the appearance of the laryn-
geal involvement, and the freedom from other tuberculous complications, as for example, intestinal tuberculosis.

Pregnancy has long been considered a dangerous complication of tuberculosis. Godskesen of Copenhagen has laid special emphasis on this condition as a complication of laryngeal tuberculosis. He reports fifty-five cases, twenty-four from literature, thirty-one from his own experience. Of his thirty-one cases, twenty-six developed the condition of the larynx during pregnancy. It usually begins insidiously and develops very rapidly. Out of the thirty-one only seven were delivered of full-term children. Only five or six of the patients were materially helped by active treatment. All the rest were unimproved and quite a number had a fatal termination. From this we gather that pregnancy is a very dangerous complication of laryngeal tuberculosis.

Lastly, let us add another important point in the prognosis, and that is the faith that the physician has in his particular type of treatment, and his skill in carrying out the details of the technique of his treatment. Whether this be a policy of "masterful inactivity" as advocated by Pottenger, or the surgical treatment of a large majority of cases as advocated by Arnoldson, much must depend upon the individual ability of the physician.

Treatment.

Upon scanning the literature of a decade ago, relative to the treatment of laryngeal tuberculosis, one is impressed with the hopelessness of any form of treatment. Even in so
recent a work as the Forcheimer-Billings system of therapeu­tics we read the statement of Hamman(25) that, "tuberculosis is not a thankful field for therapeutics by any method of treatment, it means usually advanced pulmonary tuberculosis. If ulcerative it seldom heals." On reading other leaders in the work, however, who are writing today, one gets a different impression, far different from that of the writers of ten years ago. Arnoldson, Bourack, Bar, S. Thomson, Lockard, Levy, Heryng, Schmidt, Pottenger, and others are reporting gratifying results from various forms of treatment mostly surgical. Medicinal, general, specific treatment, local application of numerous substances, all come in for their share of credit in the improved conditions.

A few actual statistics are of interest. St Clair Thomson (26) in reporting 178 cases gives 20.7 per cent arrested, with 9.4 per cent cured. Bar (17) reports 65 cases, of whom 35 with no temperature were treated, getting 11 cures, about 33 percent. At Oakdale the 66 cases of laryngeal tuberculosis that have been treated, including four still under treatment (April 1, 1915) show 10 discharged as cured, 15 percent, with 36, 54.5 per cent, of the 66 improved. Mermod (27) out of 280 cases reports 60 cured for one year, 40 for two years, 17 for three or more years, and one case for 16 years. Lockard (28) reports 154 cases with epiglottidean involvement, 29 of which, 18.83 per cent, were cured.
Treatment may be considered under three main heads, first, preventative, second, palliative, and third, curative.

Preventative treatment.

Bearing in mind what has been said earlier in this paper regarding the frequency of laryngeal tuberculosis as a secondary process, following as a rule, pulmonary tuberculosis, it would seem that certain steps might be taken to prevent the development of the laryngeal complication. The first one would be to so treat the patient that the expectoration of sputum should be stopped as early as consistent with the general welfare of the patient. This will stop the constant bathing of the laryngeal mucosa with tubercle laden sputum. Then the excessive use of the voice should be discouraged because this tends to weaken the local resistance. General hygiene should be followed up pointing to a direct beneficial influence upon the larynx. Cough, if excessive and nonproductive, should be controlled by use of steam inhalations with compound tincture of benzoin, heroin, codeine or other sedatives.

The use of irritants to the laryngeal mucosa, such as tobacco and alcohol should be strictly interdicted. Then there may exist certain pathology in and about the nose and throat that should be corrected. The nasal conditions that tend to produce pharyngitis and laryngitis, such as spurs, deflected septum, hypertrophied turbinates and sinusitis call for treatment. If the patient's general condition is good enough this treatment should be surgical,
especially if the pathology present is enough to warrant this procedure in an otherwise healthy adult. If the patient's general condition is not such as to admit of operative interference other treatment may be used, suction to clean out the sinuses, the application of astringents to the inflamed mucosa of the nose and throat to reduce the swelling and allow more freedom in breathing. The nose and throat should be kept clean from incrustations by the use of an alkaline spray. Grant (30) says that many patients date the beginning of the improvement in the larynx to the time when an alkaline nasal wash such as Dobell's solution is given. In short the patient should be made as comfortable as possible until he is in a condition for permanent relief by operation. Bucklin (29) considers the removal of a nasal obstruction sufficient to determine a cure. Grant thinks this to be an exaggeration, but it undoubtedly contains a large element of truth.

Tonsils and adenoids, if present and causing trouble, should be removed, subject to the same general considerations. As Dean (21) states "the decision as to whether this work shall or shall not be done, should be left in the hands of the expert who is thoroughly conversant with every phase of the patient's condition".

**Palliative Treatment.**

This treatment must look to the relief of pain from which the patient suffers. It may be that it is only for the hope of making the final days of the sufferer more comfortable, or it may be for the purpose of keeping up the nutri-
tion so that the successful issue of the fight is made more certain. Dysphonia and dysphagia are the two prominent symptoms demanding relief. The former can, as a rule, be relieved by strict maintenance of silence. Dysphagia, on the other hand, is often persistent and most agonizing. As before stated it is as severe for liquids as for solids. It is often produced by ulceration of the epiglottis. Extensive ulceration of the false cords and the wall of the vestibule of the larynx may cause painful deglutition. Relief for this pain may be secured long enough to permit the patient to take his food in a certain degree of comfort, by the local application of cocaine in suitable strength, 10 per cent or 20 per cent. This will, of course, last but ten or fifteen minutes and is impracticable because of this feature. Wright and Smith (11) advocate the use of alipin in 1 per cent to 10 per cent strength as an alternate for cocaine. They also state that partial anesthesia may be secured for from one to three hours by the use of an anesthetic, menthol, olive oil spray. Dennis (4) recommends orthoform applied as any local anesthetic. Hinman (31) reports not only prompt relief of pain following the use of scarlet red with sesamine oil as a local applicant, but in addition a gratifying tendency to promote healing.

Watson Williams (32) recommends the injection with a syringe of 50 per cent guiacol immediately under the ulcer. Grant and he both state that galvano-cautery-puncture under the ulcers gives relief. Grant also mentions trichlora-
cetic acid applied directly to the ulcers as an astringent for the stoppage of pain. Lake (33) recommends the application of a solution consisting of formalin seven parts, carbolic acid twenty parts, lactic acid fifty parts, and water sufficient to make one hundred parts. Morrell MacKenzie (34) recommends the insufflation of morphine in starch through a Leduc's tube. Resorcin and eurotropin may be employed in the same way. Isambert (35) favors the use of morphine in glycerin. He uses orthoform for the ulcers. Anesthesin may be used if the mucous surfaces are intact. If not it may be combined in equal parts with the orthoform.

For more permanent relief the injection of the sensory nerve of the pharynx, the inner branch of the superior laryngeal, with some liquid that will destroy it, has been recommended in numerous articles. The exact site of the injection varies a little, but all aim to get the solution in or around it about where it passes across the lateral thyrohyoid ligament. The usual solution for injection is alcohol 80 to 85 per cent with or without a little betamucaine hydrochloride grains two to the ounce of alcohol.

Hoffman's (36) technique for injection as given by Kyle (13) and Grant (30) is as follows:

"The patient is placed in a horizontal position, and with the thumb of the left hand the sound side of the larynx is pressed toward the middle line so that the affected half projects distinctly; the fingers of the left hand lie on this. The index finger enters the space between the thyroid
cartilage and the hyoid bone from without until the patient announces that a painful spot has been reached. The nail of the index finger is now placed on the skin in such a way that the spot of entrance lies opposite its middle. The needle is pushed in for about one and one-half centimeters. This distance is marked off on the needle before starting. According to the thinness of the subcutaneous layer of fat the perforation has to be more or less deep. The needle is then carefully moved until a spot is found at which the patient feels pain in the ear. The syringe, filled with alcohol at a temperature of 45 degrees centigrade is screwed into the needle, and the piston pressed slowly downward. The patient now feels pain in the ear, the passing off of which he indicates by raising the hand. During the operation speaking and swallowing must be avoided. Keep up the injection until no more pain is felt in the ear, remove the needle and apply collodion."

Boncour and Wetterstadt (37) favor the injection site in the mid line "between the body of the hyoid bone and the angle of the thyroid cartilage," believing it to be freer from danger. Davis (38) reports 12 cases with good results in 10 where relief has been secured by practically the same technique. He uses eucain grains two to the ounce of 80 per cent alcohol. He adds one point in the technique that is well to remember, that "when starting to inject, a violent attack of coughing will indicate that the injection is going into the trachea". 
The relief from pain is usually prompt. The length of time the relief exists is variable. Dennis states that it must be repeated every few days. Usually the relief lasts for from fifteen to thirty days. In the few cases that have been injected here the relief has been gratifying, but the length of time the patients have been free from pain has been very short, from three or four days to a week.

The most excruciating pain is caused by the involvement of the epiglottis with ulcerations and enormous swelling as sometimes occurs. This may be temporarily relieved by the application of any of the local anesthetics mentioned above. Permanent relief, however, can only be secured by the removal of the epiglottis. Lockard (28) of Denver, has been one of the pioneers in trying out and advocating this form of treatment. This is usually done under local anesthesia and the big boggy mass of epiglottis removed by a pair of biting forceps that slip right over the epiglottis so that it can be amputated close to its base. Sometimes the cold snare is used, sometimes the heated wire. Lockard states that "as a purly palliative measure, in advance cases, its worth has been repeatedly proved". Of 151 of his cases capable of exact analysis who were accurately observed, the pain was relieved in 127, or 84.1 per cent. It is well to state here that aside from the relief of pain, the course of the laryngo-geal lesion is favorably affected. This is due more indirectly than directly, deglutition is made easier and the increased alimentation results in improvement in the general
condition. As above quoted Lockard has in a series of 151 cases 29, 18.83 per cent, of cures. Hett (39) in a series of 350 cases performed epiglottidectomy in 24. All of these healed perfectly, and in addition to the stoppage of the pain entirely the healing of the laryngeal lesion was made more favorable.

Curative treatment.

When it comes to the question of treatment of the lesion in the larynx looking toward a healing of that lesion we at once strike a great diversity of opinion. This, as Osler often suggests would indicate that none is very satisfactory. However the trend of treatment at the present time seems to be assuming a more definite form, having passed or at least is passing through the stage of experimentation. Tuberculosis authorities as well as laryngologists are becoming united on the proposition that there are certain types of lesion demanding medicinal treatment and others demanding the more active surgical interference. There are a few men who still believe that the old policy of inactivity is the best one to follow. Pottenger in a personal communication states that with practically no local treatment, alkaline sprays being used to keep the larynx clean and in bad cases just a little argyrol from 10 to 20 per cent is very fairly used, he has obtained gratifying results, the local lesion and the lung lesion going on hand in hand to a favorable outcome. Kirschner in a personal statement also favors this form of treatment. Both these men believe
that the laryngeal lesion in its course is dependent almost wholly upon the lung lesion.

On certain general features all are agreed. The first of these is the influence of careful supervision of the daily life of the patient, his rest, diet, hygiene, exercise, and so on. Laryngologists are insistent that the patient shall be under sanatorium or hospital treatment, and those who will not place themselves under such regulation are hampering their progress, and in many instances turning the balance from recovery to a fatal termination. Absolute refraining from the use of the voice is insisted upon by all, no matter what their other treatment may be. Watson-Williams reports two cases which he considers were cured wholly by faithful silence. The cures have been followed up. One was a medical man who had remained cured for eight years at the time of his report. The second was a minister who was following his vocation and had remained cured for three years. A case of Doctor Dean's after a period of silence extending over two years came back with a perfect voice and no evidences, except a little scar tissue, of the process that had been in the larynx. Hett(39) from a study of 350 cases says that with absolute rest for varying periods usually about six months, many are healed with no other treatment.

As stated earlier in this paper much depends on the individual's determination to do his part, and this unquestionably is made easier by the carefully regulated sanatorium life. Dennis, Thomson, and many others lay emphasis on the
value of an early diagnosis, and for this reason favor the routine examination of every patient with pulmonary tuberculosis, not only at the time of his admittance to treatment, but at stated intervals during his stay. The value of such is self evident.

Much has been said and written about the effect of altitude and climate upon the course of tuberculosis. Both are unquestionably important in pulmonary tuberculosis. The one most important climatic factor so far as laryngeal tuberculosis is concerned is the amount of moisture present. If the patient has a dry non-productive type a moist climate is indicated. If it be a moist productive lesion the opposite climate is to be preferred.

Aside from the general treatment and supervision of the habits and life of the patient, certain and various substances have been proposed and tried which were applied directly to the lesion in the larynx, under the direct inspection of the eye, either by the indirect or mirror method, or more recently by the direct method. The substances proposed have been many, and good results are claimed for all. All of the substances must have one of two objects in view, or better both, the destruction of the organisms on the surface of the lesion, and the production of the one healing process in the deeper layers, that is fibrosis or cicatrization. One of the earliest to be proposed was lactic acid. Bourack gives Krause the credit for discovering and advocating the use of this well known agent. It is applied in 50 per cent solution daily to the larynx, the exact lesion
should be brushed carefully with it. No preliminary co-
canization is necessary. This is probably the best known 
and most widely used agent that we have. Krause later 
avovated the intravenous use of betol, probably to combat 
the bacteremia. Silver nitrate 5 per cent solution, is 
used especially where the diagnosis between simple and 
tuberculous laryngitis is in doubt. Formalin, owing to 
its well known bactericidal properties has been given wide-
spread trial. It is usually applied daily, beginning 
with a very weak solution, for example 10 drops of a 40 
per cent solution in an ounce of water, and gradually in-
creasing the strength as rapidly and as far as the patient 
seemed able to take it. The writer has seen it applied 
in two per cent solution with no discomfiture to the patient. 
This agent is used a good deal in the sanitoria of Colorado. 
One case that the writer saw came into the Modern Woodmen 
Sanatorium at Woodmen, Colorado, with complete aphonia. 
There is no record of the laryngeal picture, but at the end 
of three months active treatment with no other local agent 
than formalin, and the general treatment, rest, silence, 
diet, etc., the voice was completely restored, scarcely a 
trace of huskiness. Kirschner states that at the Monrovia 
Sanatorium argyrol in 10 per cent solution is the only 
agent applied to the larynx, but adds that it is used simply 
for effect, their dependence being placed on the improvement 
of the patient's general condition.

Moritz (41) suggests a classification of the lesions 
in the larynx based on methods of treatment. He gives four
classes, (a) a diffuse tuberculous infiltration with an unbroken mucosa, (b) superficial erosions and ulcers, (c) deep ulcerations, (d) tuberculomata.

Krause divides the lesions into two groups for the same purpose: (a) infiltrating and ulcerating forms, leading to ulcerative and destructive lesions, (b) slow evolution, hypertrophic form, or tuberculomata. For the first, local applications are indicated; for the second, surgical measures are indicated. It will be noted that Moritz's classification is made on the same lines, his first three divisions being in the latter's first division.

For these ulcerative types, then, topical applications are indicated. Lactic acid 50 per cent daily applied to the larynx; formalin as above given; trichloracetic acid applied with great care to the ulcers; Lake's (33) solution of formalin seven parts, carbolic twenty parts, lactic acid fifty parts, and water to make the hundred parts; are recommended by certain British laryngologists. Canastro (43) recommends the use of urea and quinine hydrochloride in such cases, and reports good results following the application. Applied with care to the ulcers, they have disappeared, pain has left, with marked improvement in twenty six days. Following this with the application of iodoform in oil alternated with lactic acid, he has obtained almost complete cures. Hinman (44) reports that scarlet red relieved the pain and tended to promote healing.
Taken alone the use of local applications has not been very satisfactory. In conjunction with other methods, surgical, general, X-ray, sun's rays, and specific, they are of distinct value.

Another line of treatment that has been advocated by certain German clinicians, and tried with rather varying success, has been the use of the X-rays and the application of sun's rays to the larynx. Blumenthal (45) reviews the literature to date and gives his own results. Witrus (46) in 1910, spurred on by the good results of X-ray and sun's ray treatment of localized tuberculosis elsewhere in the body, was led to try the use of the X-ray in a case of laryngeal tuberculosis. His first case he reports as a good result. The X-ray was applied per-cutaneous. Siebenmann (47) in the same year publishes his results in twenty cases he had treated by use of the X-ray. All were treated per-cutaneously, from front and from side. He says that in no single case did he see any improvement. He gave three other cases where X-ray was used with other treatment and with good results. Bruening next tried to apply the rays direct to the larynx through a speculum so as to avoid raying parts not desired. He used the rays long enough to secure erythema of the parts. He reports four cases in detail, and his conclusions are that there was not any very definite local improvement in any single case. Blumenthal thinks that the method of application may be at fault and so decides to try applying the rays through a laryngofissure. This was the only treatment used during the trial. Two cases
were treated with the sun's rays, two with the X-rays. The ones treated with the sun's rays showed no improvement. One of those treated by the X-rays showed no improvement, and one died. Autopsy showed that surrounding the old tuberculoma that was being rayed there was an area of new tubercles forming, which he concludes "is hardly what would be called a desirable result".

The last ten or thirteen years has brought to the foreground one of the most successful methods of treatment yet employed by the clinician, the surgical treatment. This was at first bitterly opposed, but in the last three or four years has been adopted by nearly all of the leading laryngologists. Some of the leading exponents of this form of treatment are Arnoldson, Bar, Gruenwald, Killian, Moritz, Watson-Williams, Lockard, Blumenthal, Bourack, Imhofer, Bezold, Gleitsmann, Heryng, Dennis, Krause, Levy, M. Schmidt, Mermod, Dean, and others. The object of any form of treatment has been stated for us by Grant, in the one word, fibrosis.

Surgical treatment may well be divided into two divisions: I. the use of the galvano-cautery, including fulguration by high frequency current; and II. the use of the punch or curette.

Galvano-Cautery.

This method of treatment must again be subdivided. The first form of the cautery to be used was probably that recommended by Dundas Grant, Gruenwald, Mermod, and others, the galvano-puncture. In this the point was of platinum,
fine and sharp, heated to a dull red heat. After thoroughly cocanizing the larynx the heated point was thrust into the part, under the direct view of the eye, and allowed to burn for a very short period of time. This was indicated in small tubercles in which there was no erosion of the mucous membrane, or in very small ulcers. It was claimed for it that it did not destroy any of the mucous membrane, and that it did start a fibrosis in the submucous layers that resulted in cicatrization and healing. This was also applied to very small ulcers with the same object in view, scar formation. It was also advocated by some as a treatment for the dysphagia not due to an epiglottidean lesion.

Some of the leading advocates, however, notably Mermod, after watching the results, had to admit that it did destroy some of the mucous membrane and therefore allowed some ulcer formation where there had been none, and where others were getting healing by local applications or simply general treatment. Consequently it has been pretty generally abandoned for other method, that of galvano-cautery.

Galvano-Cautery.

By this is meant the application of a platinum point, heated to a dull red by the electric current, to such tuberculous processes as experience indicates yield to such treatment. At Iowa the point in use is one made especially for the head of the department of laryngology, and consists of a fine platinum point about a centimeter long, and made of about number 22 wire. This is soldered to copper conductors, insulated from each other and from the external world.
By means of a reostat the current can be adjusted to the exact point where a dull cherry red glow is secured. By use of the direct electrically lighted spatula for larynx work (Jackson's), a good direct view of the larynx is secured. After thorough anesthesia to the part the hot point is applied for a second or two, and withdrawn while still glowing to prevent any tissue adhering. This is repeated every two weeks or oftener if progress is very favorable.

The indications for the use of the cautery are very variable, and as its use becomes more general the indications widen. The distribution of the epithelium in the larynx favor the use of the cautery, and by substitution of the scar tissue for the undesirable type of epithelium, healing is promoted. We find pavement epithelium on both surfaces of the epiglottis, and on the median portion of the true vocal cords. Here ulceration tends to be very superficial. On the edge of the epiglottis, in the vestibule on the anterior and posterior ends of the vocal cords, the arytenoids, and interarytenoid space, we have columnar epithelium. This supports the glands through which infection spreads readily. Hence the ulceration here is deeper and takes on the infiltrative type. The indications may be summed up as:

1. Tuberculous tumors of the larynx, especially on epiglottis and interarytenoid space, which are small and progressing.

2. Circumscribed infiltration with tendency to ulceration of any part of the larynx.
Bezold states that if the ulcer has an indurated border, with tubercles under the ulcer, one should hurry to cauterize. Owing to the distribution of the epithelium mentioned above, the site of these ulcers will usually be on the surface of the epiglottis, or on the middle of the vocal cord more rarely.

3. Chronic ulcerations seated upon inflammatory submucous processes, and covered with granulations which resist local treatment.

4. Unilateral affections of the larynx.

5. To the bases of tuberculomata removed from any part of the larynx by the use of the punch or curette, as a method of after treatment.

Mermod (49) states that after extensive use he has widened the indications to the gravest cases. By this he means not only the local lesion and its extent, but also the general condition of the patient. He states that it has such a beneficial effect upon the progress of the pulmonary trouble that it should be used for its healing effect. He bases his conclusions on the results in two hundred and eighty cases.

Its use in the laryngological clinic here at Iowa is largely confined to the cautery of small beginning inter-arytenoid tumors, and to the bases of larger tuberculomata removed by use of the punch. This is due largely to the fact that with the close supervision that the tuberculous patients have here, the graver, more extensive lesions do not
appear.

Contraindications.

These are naturally decreasing as the indications increase, but some still must be considered.

1. Advanced pulmonary tuberculosis, complicated by fever and cachexia. It will be recalled that the statistics from the Basle Clinic (see Bar 17) show that in such cases the percentage of good results is only 3, while in those who had no fever there was a percentage of 35, good results.

2. Pronounced laryngeal stenosis occasioned by inflammatory tumefaction of the parts.

Although it was formerly feared that the cautery would result in extensive edema, and a tracheotomy be made necessary, experience here as elsewhere, shows that only a very little edema, if any, results from the treatment. With an extensive stenosis, a very slight amount of edema might cause grave results.

3. Miliary tuberculosis of the larynx and pharynx. Here if anything will give a good result it will be the more radical form of cautery through laryngofissure, with the local treatment, and complete rest secured by the tracheotomy wound.

4. Excessively nervous patients with little resistance.

Fulguration.

This method of treatment is being employed at the present time in the cities of the east. The writer
has seen no statistics of their results, so that the success of the method is not known.

II. Use of punch, Curette, or Both.

Perhaps the most extensive investigation and report of the treatment of laryngeal tuberculosis by surgical means is that carried on by Arnoldson (50) of Stockholm. He gives in detail the history, physical findings, laryngological findings, treatment and results secured in thirty four selected cases from a series of six hundred cases.

By this type of surgical treatment we understand the removal by means of a suitable punch, cutting forceps, or a cutting curette, of such lesions in the larynx as experience shows should be so removed. This is done here at Iowa by use of the direct, electrically illuminated spatula. After thorough anesthesia to the parts the spatula is introduced and the part to be excised is removed by the forceps or curette under direct vision. Sometimes the Killian suspension laryngoscopy is employed, but aside from the difference in presenting the field to view the technic is exactly the same.

Arnoldson gives as his compiled indications for operation as well as from his own extensive experience, the following:

1. Diffuse infiltrating types with tendency to deep ulceration (perichondritis) if widespread with diffuse infiltration, can be helped in no other way, and by surgery (excision of tumors and cautery to surfaces) there is hope of limit-
ing the process and preventing stenosis.

2. Tumors and polypi that cause either dysphonia or dysphagia should be removed as a palliative measure. Beginning tumors in the interarytenoid space that appear too large for cautery control should be excised.

3. Diffuse infiltration of parts of both vocal cords, or even of one entire vocal cord (if arytenoids are movable) can be removed, with hope of cure and restoration of the lost cord and return of function.

4. Small or large ulcers if so located as to permit of excision should be excised. He favors the amputation of the epiglottis as a palliative as well as a healing measure.

Contraindications.

The main contraindications are much the same as those against the use of the cautery; lack of resistance and nervous temperament. To this must be added that if there is any indication clinically of malignancy it should not be touched more than is absolutely necessary for securing a piece for diagnosis, because of the well known effect that an incision or excision of a part has on the growth of neoplasms. He regards the subglottic location of a tumor sufficient evidence of its non-tuberculous character as to prevent any attempts at removal.

Exo-laryngeal Surgery, Laryngo-fissure, and Tracheotomy have been advocated by some, but the seriousness of the operation is such as to prevent its employment in any but the most hopeless cases, and then only for hope of euthanasia.
The endolaryngeal operation, on the other hand, is so simple, and done with so little discomfort and so few bad after results to the patient, that it makes the more extensive operation one of last resort.

The curette is employed as a useful adjunct to the punch forceps, being used in the same manner and for the same purpose in those cases of small tumefaction, too small to be grasped by the forceps, and for use in wider ulcerated, and especially for secondarily infected, areas. It is also indicated in those cases apparently of the right type to be treated with the cautery. In such cases when they fail to respond to repeated cauteries, a thorough curettage often starts the larynx toward a rapid recovery.

In the cases we have had here the usual treatment is to first remove the tuberculoma, with the forceps, curette its base, then in the course of a few weeks, local applications of fifty per cent lactic acid being continued in the mean time, if there is still a small amount of tumefaction and infiltration, to again thoroughly curette out the parts. This is repeated at intervals of two or three weeks, some times alternating with the cautery, until the tumefaction, ulceration, or infiltration, has disappeared and residual scar tissue has taken its place. The results have in many instances, as shown by the tables in this paper, have been most gratifying. We find that with the surgical treatment, local applications between surgical measures, and general dietetic and hygienic treatment all the time, the percentage of cures has gradually increased.
The one fact that many cases of tuberculosis have a better result in the larynx than they do in the pulmonary lesion shows very markedly the efficacy of the treatment. Beyond this it is rare to find a case where the pulmonary lesion improves and the laryngeal lesion grows progressively worse. Arnoldson, Bar, Grant, Morris, Bourack, cite cases to show the same fact, that is, the improvement of the larynx is followed by improvement in the lungs, and the improvement in the larynx is often more rapid than in the lungs. When one recalls that less than twenty-five years ago, the presence of a laryngeal complication was regarded as practically fatal one is pardoned for some degree of enthusiasm.

There is one other surgical measure which is seldom employed, because of the rarity of the two associated conditions calling for it. Zink (51) reports five of a series of twelve cases where laryngeal tuberculosis existed as a complication of an extensive unilateral pulmonary tuberculosis. The lung condition, in and of itself, was an indication for artificial pneumothorax. It was accordingly done. Four of the five cases healed completely. The fifth died from intestinal tuberculosis. Zink draws the conclusion that the healing of the larynx followed the healing of the lung, largely because of the decreased sputum and other factors producing the laryngeal lesion.

The use of tuberculin as a therapeutic agent in tuberculosis of any part of the body is too well established to
need comment. It is of especial value in the treatment of laryngeal tuberculosis, as it is in ocular tuberculosis, because of the ease with which the progress of the treatment and the regulation of the doses can be controlled. The focal reaction shows nearly as plainly as it does in the eye.

Summed up in a few words, then, the treatment of laryngeal tuberculosis is no longer hopeless, a proper perspective of the value of the different modes of treatment must be maintained. General supervision, diet, rest, especially of the voice, climate, all are important no matter what the special mode of treatment, be it surgical treatment, galvano puncture, cautery or curette. All have an important place, while local application, by some thought to be of great value and by others of no value, have their place as an aid to the more radical procedures. A statement such as made by Wylie (53) that "tracheotomy with the attendant rest of the voice is the best treatment in all cases" finds little place in the broader view of the value of each and all the different methods. Tracheotomy, laryngo fissure or even total extirpation of the larynx as reported at various times by Desault, Billroth, Gruenwald, Pieniaczek and Glueck, is given by them as an operation of last resort, to prolong life a little longer with no definite hope of permanent improvement. If undertaken with the full understanding of the patient that such is the only object, the measures are certainly justified.
Treatment at the Iowa Clinic.

For the sake of clearness, even at the risk of repetition, let us again briefly state the method of treatment of tuberculosis of the larynx which has been employed here in the department of laryngology. Let it be said that since the work has been carried on in such close relationship to the State Sanatorium for the Treatment of Tuberculosis, not a small portion of the success met with depends upon the cordial cooperation of the two institutions.

General Treatment.

This is regarded as of prime importance. It is carried out under the direction of the Sanatorium. Rest of voice, rest of body, best of hygiene are insisted upon.

Local Treatment.

In the treatment of the lesion locally three considerations are important: time, continual observation, and cooperation of the patient. Time is needed to see the result of the particular form of treatment. Healing is a slow process, as a rule, and the patient must know that it is to be a long pull for him. Continual observation is necessary in order that the mode of treatment may be changed if the patient is not doing well. This is true of the surgical methods as well as of the local applications. Cooperation of the patient is absolutely essential to good results. If he or she is not willing to do his or her part by careful regulation of the mode of life, rest of voice or following whatever treatment is prescribed, there can be no hope of cure.
Methods Employed.

The treatment may be said to consist of combined surgical and medicinal treatment. As a rule when the diagnosis is made local applications are first tried; lactic acid fifty per cent applied to the larynx daily or twice daily being the first prescription. If there develops a small infiltration of the vocal angle or interarytenoid space, the cautery is tried, applied with the direct laryngeal spatula directly to the area desired, repeating every fortnight. The local applications are continued as before. If the infiltration does not yield to this treatment in the course of one or two months, curettement of the infiltrated area is tried. This is followed by steam inhalations with compound tincture of benzoin for twenty minutes every two hours. If the infiltration now subsides the cautery is resumed; if not the curette is again used in two weeks.

If there is a tuberculoma in the interarytenoid space, or a well circumscribed tuberculoma of the false cords, or a small tuberculoma or ulcer on the true cord, this is removed by the laryngeal forceps, Corde's forceps being used. If an interarytenoid tuberculoma, in addition to the excision, the base is curetted. Then the local applications of lactic acid are carried out as above. Following this the cautery is used, or the curette, the choice being dependent upon the return of the tumor or infiltration. Tuberculomas may have to be excised several times, but as a rule two or three excisions bring them down to the point
where they can be controlled by other methods.

If the local application of lactic acid does not seem to be causing the lesion to fibrose, a change is made to formalin, usually one per cent. Sometimes in very nervous patients, or those not doing well under the other two, argyrol in forty per cent solution is used. It must be emphasized that the success of treatment is based upon constant observation and a prompt change of treatment when change is indicated. It should be added also, that the use of tuberculin is left wholly with the Sanatorium, though often recommended to them by us.

Below is given a table with the sixty six cases treated at Oakdale Sanatorium by the laryngologist of the state, in the Department of Laryngology of the State University of Iowa College of Medicine. It shows the results in each case, his general condition at the time of discharge, or at present if still under treatment; and the same for his laryngeal lesion. The classification of his lung condition is made in accordance with the 1914 Classification adopted by the National Association for the Study and Prevention of Tuberculosis. Unfortunately no such standard for the laryngeal lesion exists, but is left to the discretion of the individual laryngologist.

1914 Classification.

Apparently Cured:— All constitutional symptoms and expectoration with bacilli absent for a period of two years under ordinary conditions of life.

Arrested:— All constitutional symptoms and expecto-
ration with bacilli absent for a period of six months, the physical signs to be those of a healed lesion.

Apparently Arrested:— All constitutional symptoms and expectoration with bacilli absent for a period of three months, the physical signs to be those of a healed lesion.

Quiescent:— Absence of all constitutional symptoms; expectoration and bacilli may or may not be present; physical signs stationary or retrogressive; the foregoing conditions to have existed for at least three months.

Improved:— Constitutional symptoms lessened or entirely absent; physical signs improved or unchanged; cough and expectoration with bacilli usually present.

Unimproved:— All essential symptoms and signs unabated or increased.

Table showing the results of Treatment of the Larynx and the pulmonary condition.

The abbreviations used in the Laryngeal columns are I - Improved, U - unimproved, C - cured; and those in the pulmonary columns are in accordance with the above classification. D is added for death.

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The following are some of the cases that have been treated, with the results of that treatment given in abstract. Some are cured. Some have gone out from under observation, and some others are still under treatment. The status of the patient at the present time if obtainable is given in each case.

The classification of the patient's condition in so far as his lungs are concerned is made in accordance with the original classification of Turban (52), a simple, easy, but not a very scientific classification. In addition to Turban's classification it is the practice at Oakdale to place all cases having any complication of the pulmonary in the Turban III class.

Turban I:— Disease of slight severity, affecting at most one lobe, or two half lobes. (By slight severity is meant disseminated foci manifest clinically.)

Turban II:— Disease of slight severity, more extensive than the first, but affecting at most two lobes, (or four half lobes) or if severe affecting only one lobe.

Turban III:— All cases of greater extent than the above two.
CASE REPORTS

1. A.B. m alt 31. Patient has a good family history. He enters the Sanatorium June 20, 1913, complaining of extreme malaise resulting from a hard cold three months previous, from which he had not yet recovered. His condition at that time was Turban III, with involvement of all lobes of both lungs. Bacilli were found in the sputum. He also complained of hoarseness, and a diagnosis of simple chronic laryngitis was made. He was treated with silver nitrate five per cent applied to the larynx daily and with steam inhalations containing compound tincture of benzoin. On November 26, 1913, a diagnosis of laryngeal tuberculosis was made. The cautery was used with lactic acid daily in fifty per cent strength applied locally. From December 5, 1913, to September 28, 1914, he was cauterized eighteen times at intervals of about two weeks. On July 8, 1914, he was discharged from the Sanatorium to its pay roll with his pulmonary condition quiescent. On September 28, 1914, he was discharged from the clinic with his laryngeal condition apparently cured. On December 7, 1914, he was demonstrated to the Alumni Clinic as a case of cured laryngeal tuberculosis. His condition at the present time, both the lungs and the larynx, is excellent.

2. T.G. m alt 24. Patient has a negative family history. First admitted to the Sanatorium in 1909. After treatment he was discharged to the pay roll of the institution, working at farm work. Spent one year abroad, return-
ed to work in April, 1911, on the Sanatorium farm. His attention was drawn to hoarseness and tachycardia on April 12. On the 24th of that month he came to the clinic complaining of hoarseness not associated with a cold. Examination showed a large tubercle in the interarytenoid space. May 8, 1912, he reentered the Sanatorium as a patient, and on May 17 the tuberculoma was excised. His general condition at that time was far advanced, and he was given an unfavorable prognosis. His case was complicated by the presence of very badly diseased tonsils, which were removed January 20, 1913. From May 28th, 1912, to November 14, 1913, the patient was cauterized thirty nine times at intervals of about two weeks. Between cauteries the usual lactic acid treatment was carried out. In August the tuberculoma in the interarytenoid space reappeared, but the cautery was the only treatment employed. One interesting point in this case must be noted, the presence of the badly diseased tonsils. Improvement was slow up to the time of their removal in January, 1913. From that time on progress was very satisfactory, and in May he was described as in fine condition. November 11, 1912, the left false cord was cauterized, a small ulcer having appeared. This seems to have scarred over at once, for this point was not cauterized again until nearly a year later. In October 1913 it was found necessary to cauterize the right false cord for the same purpose. In spite of the unfavorable prognosis that had been given on admit-
tance, the patient was discharged from the Sanatorium on December 23, 1913, with his lungs and larynx improved. His present condition is not known.

3. R. W., m alt 18. Patient has a negative family history except for one sister who has bronchial trouble. He entered the Sanatorium March 24, 1913, complaining of a cold and cough that had persisted for about three months. He had run temperature, had chills, anoxeria, and sputum. Tubercle bacilli were found in the sputum. His general condition on admission was far advanced, Tuban III, with one right lobe and all of left involved. He was given an unfavorable prognosis. On March 26, 1913, he came to the clinic on account of hoarseness. Examination showed tuberculous laryngitis. He was put under the usual treatment locally and the cautery was used. From April 9, 1913, to June 3, 1914, the cautery was used twenty six times. After three times, June 25, 1913, December 10, 1913, and May 6, 1914, the larynx seemed practically well. He was discharged from the Sanatorium to its pay roll on April 21, 1914., with his lung condition apparently arrested. Tubercle bacilli were still present in the sputum. On May 6 his larynx was said to be practically well. He remained at the Sanatorium until February 1915 and his laryngeal condition and pulmonary condition were watched. When he passed out from observation he was "well and strong", his lung condition apparently arrested, his larynx cured. May 19 he was at work canvassing, his general condition be-
Mrs. R. is 36. She had a suspicious family history, two cases of prolonged pneumonia, and three cases of death following a chronic illness not diagnosed. Her past medical history was good except for severe attacks of "grippe" every winter for the previous three years. She entered the Sanatorium April 15, 1913, complaining of cough, sputum, fatigue, fever accompanied by chills, hoarseness, loss of weight and strength. Her condition was Tuberculosis III at that time; involvement was far advanced, with all lobes of both lungs involved. There were tubercle bacilli in the sputum. Her prognosis at that time was unfavorable.

May 7, 1913, she came to the Clinic complaining of hoarseness, but more particularly of a constant unproductive cough. Examination showed "a very suspicious larynx", and a diagnosis of tuberculosis of the larynx was made. Treatment by cautery, lactic acid, and rest to the voice were prescribed. The first cautery was made May 24, 1913. From this date until May 27, 1914, she had twenty cauteries, three curettements of the larynx, and one tuberculoma removed.

Two months after the first cautery there was marked improvement of the appearance of the larynx. November 21, 1913, she had her first curettement. December 3, 1913, she had her second cautery. January 7, 1914, the larynx showed great improvement. March 25, 1914, a tuberculoma appeared in the interarytenoid space. This was excised,
and its base curetted on March 27, 1914. The excised
tuberculoma showed typical histological tuberculosis.
April 8, 1914, the larynx showed wonderful improvement.
May 27, 1914, the throat was practically well but was given
a final cautery. May 31, 1914, she was discharged from the
sanatorium with her lung condition quiescent, and her larynx
greatly improved.

This patient is a good example of what can be done in
the face of a very unfavorable prognosis, through persistent
treatment and earnest cooperation on the part of the patient.
She carried out her part of the treatment conscientiously.

5. T. J. D. alt 35. The patient had a good fam­
ily history and a good personal history except for a severe
attack of "grippe" two years previous, and a severe attack
of pneumonia in 1913. She entered the Sanatorium July 15,
1913, complaining of cold with cough and sputum, fatigue,
malaise, loss of weight, rapid and marked, loss of strength
and some hoarseness. Her condition at that time was Tur­
ban III, far advanced, and with three lobes, two right and
one left, involved. Tubercle bacilli were in the sputum.
On account of her apparent lack of resistance she was given
an unfavorable prognosis.

July 30, 1913, she came to the Clinic complaining partic­
ularly of hoarseness. Examination showed an ulcer on the
false vocal cord and a diagnosis of tuberculous laryngitis
was made. Cautery treatment with lactic acid, steam in­
halations with compound tincture of benzoin every two hours
was started. Her first cautery was done September 19, 1913,
and the second October 4, 1913. The long delay from the
time of the diagnosis in July until active treatment start-
ed in September was due to her poor general condition, she
being unable to come into the clinic.

October 10, 1913, she was discharged from Oakdale unim-
proved. She entered the clinic for active treatment as
above outlined. From the date of hospital entry until her
discharge she received four cauteries and had one excision
of a tuberculoma. Her larynx improved rapidly, beginning
as soon as she entered the hospital. April 4, 1914,
she went out to the Sanatorium for an examination of her
lung condition, and the Superintendent reported himself
"much pleased with her progress".

April 5, 1914, she left the hospital weighing thirty
two pounds more than she did on admittance to the Sanatorium
and feeling better in every way. From this time until Feb-
uary 27, 1915, she received twelve cauteries and had her
larynx curetted once, September 25, 1914. Since that time
she has reported once a month for observation of her larynx,
and for two months the larynx has looked fine and the patient
seems remarkably improved in every way.

This patient has been under constant observation and
treatment the longest of any of the cases reported. She
shows even better than the previous case the benefits of
persistent treatment. She has done her share of the treat-
ment remarkably well and the good progress made is due in no
small part to her painstaking observance of the details
of the treatment which she had to carry out.
6. O.W. m alt 38, Gas fitter. The patient had a good family history, good habits. His past medical history is nonimportant. He entered the Sanatorium February 12, 1914, complaining of an acute attack of cough, sputum, hoarseness, anorexia, malaise, and typical symptoms of pulmonary tuberculosis. Examination showed Turban III with two lobes of the right, and one of the left lung involved. His prognosis was favorable. Tubercle bacilli were present in the sputum. His hoarseness persisted and on April 22, 1914, he was first examined at the clinic. The signs in the larynx at that time were not sufficiently well marked to make a diagnosis and he was given local applications of silver nitrate five per cent daily for two weeks, when a tuberculoma appeared on the left cord and the diagnosis of laryngeal tuberculosis made. The usual treatment of cautery, with lactic acid was begun. From May 15, 1914, to December 8, 1914, he was cauterized twelve times. August 5, 1914, the larynx was practically well, but a week later a small ulcer appeared on the left cord. Again on November 11, 1914, the larynx was so well that treatment was stopped for a week. Following this the cautery was used twice and he was then discharged from the clinic to report once a month for examination of the larynx. On February 10, 1915, his larynx was examined and found to be perfectly well. He was discharged from the Sanatorium to its pay roll on March 15, 1915, with his lung condition apparently arrested. Tubercle bacilli were still present in the sputum. He still reports to the
clinic but the last report, March 10, 1915, gives the larynx in excellent condition. On May 19, he was at work, feeling fine, doing light work.

7. R.O. f alt 24. The patient had a rather tuberculous family history, one brother having died of pulmonary tuberculosis in 1911. She entered the Sanatorium, September 30, 1913, complaining of loss of weight, fatigue, night sweats, catching cold easily, pleurisy, and hoarseness. This hoarseness persisted from October 1912 to the time of her death in November 1914, from chronic nephritis. Her condition on admittance was Turban III, with one right, and two left lobes involved. Tubercle bacilli were present in the sputum. She was given an unfavorable prognosis. On January 14, 1914, she was first sent to the clinic for examination of her throat, and the diagnosis of laryngeal tuberculosis made. The treatment of cautery, rest of voice, lactic acid, and steam inhalations with compound tincture of benzoin was added. Cauterization was begun January 17, 1914. From this date until September 25, 1914, at about two week intervals the patient had thirteen cauteries together with the removal of tuberculomata from the interarytenoid space on three occasions, March 18, 1914, September 18, 1914, and October 7, 1914. Microscopical examination of the tuberculomata excised on October 7, 1914, showed typical tubercles with caseating areas, giant cells, and small round cells infiltrating. At her last visit to the clinic, October 21, 1914, the larynx was looking good. From the time of her entrance she had nephritis which persisted through
her entire stay. On November 17, 1914, she was discharged from the Sanatorium unimproved and a week later died from the nephritis.

8. Mrs. B.H. f alt 43. Patient has suggestive family history, having one brother dead of tuberculosis at fifteen years of age, one sister having tuberculous glands. Her past medical history was suggestive also, having had "grippe" every winter for twenty years, and a severe attack of pneumonia twelve years ago. In August, 1912, she had pleurisy following what was called asthma. She entered the Sanatorium December 12, 1913, complaining of anorexia, loss of weight, twenty pounds, and hoarseness dating from May 1913. Her condition at that time was Turban III with all lobes of each lung involved. Tubercle bacilli were present in the sputum. She was given an unfavorable prognosis. January 7, 1914, she came to the clinic complaining of constant hoarseness. Her throat was not sore and did not seem dry. No cough.

Examination of the larynx showed a large interarytenoid infiltration. Diagnosis of laryngeal tuberculosis was made, and the cautery with the usual local and general treatment prescribed. The first cautery was done February 28, 1914, and from that time until October 28 she had twelve cauteries at intervals of about two weeks. From the 25th of July to the 16th of September she had no cautery. October the 28th she had an acute exacerbation of her laryngeal trouble involving the larynx and pharynx. The diagno-
sis of an acute laryngitis upon a tuberculous laryngitis was made, and the patient advised to come into the hospital for a few days. Here the throat was treated twice daily with 40 per cent argyrol. On November 11 she was sent back to Oakdale in good condition. On November 15 she was discharged from the State Sanatorium to enter the Scott County Sanatorium. March 10, 1915, she returned to the clinic for examination, having just returned to the state Sanatorium. At this time the throat looked fine, there was a slight infiltration in the interarytenoid space, and a slight redness of the vocal cords. Local treatment was stopped, and on April 14 she came in for examination. A small ulcer was seen on the left arytenoid. This was cauterized. Her last examination at the clinic on May 15, 1915, shows the larynx in good condition. Owing to the rapid development of a recurrence of her pulmonary trouble she was sent home. Her prognosis was so grave that she wished to be at home for the final outcome.

9. Miss E.C. f alt 24. Patient has a good family history. Her habits have been good, but she has had very hard work in the city. Her past medical is suggestive, having had a bad attack of influenza five years ago. She had malaria-typhoid for three weeks following this. She entered the Sanatorium June 1, 1914, complaining of loss of weight of fifty pounds (140-90), loss of strength, pleurisy with effusion and hoarseness. Her condition at
that time was Turban III with one right lobe and two left lobes involved. She was given an unfavorable prognosis. In May 1914 she was examined at the clinic, and a diagnosis of laryngeal tuberculosis made. The cautery treatment with local applications of lactic acid fifty per cent with rest of voice, steam inhalations with compound tincture of benzoin were prescribed. She had her first cautery June 21, 1914, and had a marked reaction following it.

It must be said that the patient was so extremely nervous that nearly every cautery was attended with greatest difficulty, and the patient would almost collapse for an hour or two following. Between June 26 and August 21 she had five cauteries. At this time the local treatment was changed to formalin one per cent applied daily. This was continued until October 9, 1914, when she was cauterized the sixth time. On November 13, 1914, she developed a tuberculoma in the interarytenoid space. She was brought to the hospital and the tuberculoma curetted. She remained in the hospital, and on November 18 small ulcers appeared in the mouth, on the lips, and on the epiglottis. Dysphagia was very marked. December 1, 1914, a diagnosis of tuberculosis of the epiglottis was made. Local anesthetics, cocaine and orthoform powder were dusted on the epiglottis and in the larynx before the patient tried to swallow food. Liquid foods by mouth and nutrient anemata were given. December 9, 1914, the epiglottis was removed. This was examined histologically and showed tuberculosis invading as deep as the perichondrium. For a few days
following the removal of the epiglottis swallowing was very much easier and she was able to take liquids freely with no pain. Pain reappeared on the 15th and the patient was unable to stand the local treatments of 10 per cent argyrol. After the operation on the epiglottis, with the exception of a few days, from December 13 to 17, when she ate with no pain, the patient was almost constantly under the influence of opiates. During the entire period of her final illness she had temperature ranging from 100 degrees F. to 104 degrees F. Exitus January 5, 1915.

10. Mrs. S.Y., f alt 38. Patient presented a good personal history and excellent family history. She entered the Sanatorium December 1, 1914, complaining of hoarseness, night sweats, enlarged cervical glands, and loss of weight from 148 to 121 1/2 pounds. Tubercle bacilli were present in the sputum. The above symptoms began in May 1914, consequent to a cold developed in February 1914. Her condition at that time was Turban III, far advanced, all lobes of both lungs involved. Her prognosis at that time was unfavorable. December 4, 1914, she came to the clinic on account of the persistent hoarseness. Examination showed tuberculous laryngitis, and the cautery treatment was prescribed. She entered the hospital and was cauterized, remaining there two days, December 8 and 9. From this date until May 5, 1915, she received eleven cauteries. On March 23, 1915, she entered the hospital
for the purpose of curettement and removal of a piece from the larynx. This was done on the 24th of March. The Killian suspension method was tried but was not successful. The direct spatula was then introduced and a piece excised and the base curetted. She was then returned to bed and placed in a croup tent.

The soreness following this treatment soon disappeared and she returned to the Sanatorium on March 27, 1915. She has been under treatment about four months. The larynx in this time has improved a great deal, and the Sanatorium report on her general condition is one of excellent progress.

11. Miss G.S., f alt 27, saleswoman. Her family history is bad, her mother having died of tuberculosis twelve years ago. She entered the Sanatorium October 19, 1914, complaining of cough, hoarseness and rapid loss of weight from 137 to 123 pounds. Her condition at the time of entrance was Turban III, far advanced and all lobes of both lungs involved. Tubercle bacilli were present in the sputum and in the feces.

November 12, 1914, she came to the clinic on account of the soreness and a feeling of dryness in the throat. At the time she was not hoarse. The dryness caused her to clear her throat a great deal. Examination of the larynx showed the cords covered with mucous, the interarytenoid space infiltrated, and several large tubercles present. The entire larynx was inflamed, as was also the pharynx and naso-pharynx. Doctor Dean described the laryngeal appear-
ance as typical tuberculosis. The cautery treatment was prescribed with curettements when necessary.

A removal of the tubercles was advised at once. She entered the hospital and on November 13, 1914, the tuberculomata were removed and the bases curetted. There was little or no reaction. During her stay in the hospital the throat was alternately treated with lactic acid 50 per cent and argyrol 40 per cent. She had steam inhalations with compound tincture of benzoin every two hours. She had practically no temperature during her stay and returned to Oakdale on November 18, 1914. From this date until May 5, 1915, she had five cauteries. On May 7, 1915, she had another curettement of the larynx entering the hospital for a few days. She was very nervous at the time of the curettement. Killian apparatus was used successfully.

Her laryngeal condition at the present, May 19, shows that the curettement has done a great deal of good. Her general condition is not the best. Her progress for the first two months of her stay at the Sanatorium was good, but later, owing to the intestinal involvement it has been poor. She is still under treatment.

12. Mr. R. m alt 67. Patient's family history was negative. He had had a cough for years. Eight years ago he had had a breakdown and had taken sanatorium treatment. His occupation, that of fire chief, had caused a great deal of exposure and much use of voice. He had been hoarse for over a year prior to his admission to the Sanatorium, September 4, 1914. His huskiness of voice led him to have
an examination of his lungs, having had no constitutional symptoms at all. His condition at the time of entrance at Oakdale was Turban III, with one lobe of the right, and none of the left involved. On account of his age he was given an unfavorable prognosis. Tubercle bacilli were present in the sputum.

He came to the office for examination of the larynx. Both cords were badly swollen, with a large tuberculoma in the interarytenoid space. He entered Mercy Hospital September 15, 1914, for removal of the tuberculoma. This was done September 16, 1914. He was placed in a croup tent with steam inhalations constant. He suffered little discomfort, and was up and about in a few hours. His treatment was the same as usual, lactic acid, steam inhalations with benzoin.

Examination of the piece excised showed very typical tubercles with round cells, giant cells, caseating center. Stained with carbol-fuchsin the tubercle bacilli were shown in the sections.

The larynx at time of discharge, September 29, 1914, showed some infiltration of the left cord. Since that time he has had three cauterities, one in January, one in February, and one in May. At the recent time he was in good condition, his voice was less husky, the swelling of the cords less and the interarytenoid infiltration much less. One thing that militates against progress in this case is the inability of the patient to keep from using the voice.

On December 10, 1914, he was discharged from the Sana-
torium, greatly improved, and with his prognosis changed
from unfavorable to favorable. During the time between treat-
ments he has had local applications of lactic acid twice a
day at home. He is still under treatment and doing
very well.

13, Mr. A.A., m alt 32. Patient presented rather a
poor family history, his father having died of tuberculosis.
He entered the Sanatorium on January 5, 1915, complaining
of loss of weight, strength, and hemorrhage at times. He
had been very susceptible to colds, had had severe attacks
of cold for three years. Tubercle bacilli were present in
the sputum. His condition at the time of entrance was
Turban III, far advanced, with involvement of the lobes of
the right and one lobe of the left. He was given an un-
favorable prognosis.

On January 20, 1915, he came to the clinic on account
of his hoarseness. He had no pain. Examination showed
a polyp at the posterior end of the right true cord. A
tentative diagnosis of specific laryngitis was made. A
week later examination showed a subglottic tumor on each
side of the larynx. On or about January 24 a piece was
excised and sent to the pathologist. Examination of this
showed tuberculosis. Stained for tubercle bacilli they were
found to be present. The subglottic tumor was so suggest-
ive that a Wassermann was asked for, but not secured. On
March 17, 1915, he was cauterized.

His lung condition at the present time is getting worse;
his loss of weight and anorexia continue, and due to his
unfavorable progress nothing at the present time can be
done for his larynx.

14. Miss M. K. f alt 17. Patient Has a poor family
history, both grandmothers having died of tuberculosis, her
father has asthma. Her life has been spent in the country,
but has slept with no ventilation. On October 16, 1914,
she entered the Sanatorium complaining of fatigue, pain in
the chest, cough, night sweats, blood in sputum, amenorrhea,
loss of weight and strength. Her condition at that time
was Tuberc III, far advanced, with one lobe of the right
and both of the left involved. Tubercle bacilli were pres­
ent in the sputum. December 5, 1914, she entered the clin­
ic for relief from her hoarseness. Throat was sore a lit­
tle at times. Examination led to the diagnosis of laryn­
geal tuberculosis and the usual cautery treatment with lo­
cal applications of lactic acid prescribed. She was caut­
erized four times between December 7, 1914, and February
3, 1915. Since that time her general condition has been
such as to prevent her coming in for laryngeal treatment.
Her progress from the standpoint of her lungs is very unsat­
isfactory. She left the hospital at Oakdale May 20, 1915,
with her larynx in excellent condition, no hoarseness, no
dysphagia, voice was clear.

15. Mr. T.G. m alt 35. Patient was referred to the
clinic by a physician of the state for examination of his
throat. He entered the clinic and the hospital April 5,
1915. His chief complaints were dysphagia and hoarseness.
Last winter his throat was sore a few times but not severe enough to give him any concern. Six weeks before admission his throat began to pain him when swallowing and has pained him ever since. His history is a little unusual in that the swallowing of solids was more painful than the swallowing of liquids. He had no dysphonia.

Examination of the larynx showed that the epiglottis was nearly all gone, being attached only by a small pedicle. The arytenoids were very much swollen and the larynx was covered with a white ulcerous membrane. A piece of the epiglottis was removed on April 6 for pathological diagnosis. An examination of his lungs showed, according to the report of the Department of Internal Medicine, lesions at each apex. On April 10 an epiglottidectomy was done. It was the typical turban shaped epiglottis. The removal was done under local anesthesia and caused but very little inconvenience. The histological examination of the epiglottis showed it to be tuberculosis, with the typical tubercle formation. Stained with carbol-fuchsin the section showed tubercle bacilli.

The removal of the epiglottis did not alleviate the patient's dysphagia according to his statement. The base of the epiglottis was soon covered by a thick gray membrane. By removing this, which was done with ease, there were found to be many ulcers. The cords showed no change. He remained in the hospital for three days following the epiglottidectomy, when he left and went home.

May 5, 1915, he again came to the clinic, this time
from Oakdale. He still complained of dysphagia. Examination showed the larynx and the stump of the epiglottis covered by ulcers and a dirty membrane. The uvula was edematous and ulcers were forming on the soft palate, tonsils and posterior pharyngeal wall. This is a case of tuberculosis of the larynx and pharynx, of the rapidly spreading type. The only treatment is palliative, lactic acid 50 per cent was prescribed to be applied to the parts twice daily.

16. Mr. L.K. m alt 34. Patient is a carpenter by occupation, of good family history and good personal history prior to admission. His habits were good. His past medical history was suggestive, having had pneumonia seven years ago, and influenza every fall for the past four years. He had had attacks of pleurisy. He entered the Sanatorium July 3, 1914, complaining of a loss of weight of twenty pounds, cough, sputum, huskiness of voice amounting to almost complete aphonia. His lung condition at that time was Turban II, his case moderately advanced, with two lobes of the right and two of the left involved. Tubercle bacilli were found in the sputum. Because of the long duration of the disease, and the patient's resistance to it he was given a favorable prognosis. September 16, 1914, he came to the clinic on account of his throat, the particular complaint being dysphagia of a week's standing. At this time he had no hoarseness.

Examination of the larynx showed the left half of the epiglottis gone, with a clean punched out appearance. On
the left side of the epiglottis there was cauliflower-like excrescence. The diagnosis of tuberculosis of the epiglottis was made with ulceration of the edges and a polyp on the left side. A week later a piece was removed with the biting forceps for microscopical examination. This showed the process to be histologically tuberculosis. Following the epiglottidectomy the larynx made marked progress, so that on October 7 it was "almost well". He was seen again on the 14 of the month and the larynx was still doing well. October 21, 1914, he left the Sanatorium in bad condition. On January 31, 1915, he died of pulmonary hemorrhage.

This case is reported to show particularly the prompt and beneficial results of epiglottidectomy. The patient was able to eat in comfort. He gained in every way although the most marked gain was in the larynx.

Miss A.T., aged 40. The patient had a fair family history. She took care of a sister-in-law who died one year ago of tuberculosis, March 1914. In November 1914 she developed a cough, began to feel unusually tired, growing fatigued very easily, and had a rather rapid loss of weight of eighteen pounds. She entered the Sanatorium March 2, 1915, complaining of the above symptoms, and also of hoarseness of three months duration, that had recently developed into aphonia. Her condition at that time was Turban III far advanced, with all lobes of both lungs involved. Tubercle bacilli were present in the sputum. On account of the rapid development of the serious symptoms she was given an unfavorable prognosis. March 3, 1915,
the day after her admission to the Sanatorium, she came to the clinic for relief from the above same symptoms. To these was added a marked dysphagia. At this time the larynx was reddened and the epiglottis badly inflamed. The arytenoids were also swollen and the cords were rough and swollen. On account of the bad sinusitis that was present the diagnosis was withheld until further observation, treatment being given for the sinusitis, suction and alkaline nasal spray. A week later there was a marked tubercle in the interarytenoid space, and the false cords were markedly swollen. A diagnosis of laryngeal tuberculosis was made and the cautery treatment started, the first cautery being given March 12, 1915. On March 19 she had the larynx curetted. She did not come to the clinic again until April 28, at which time her larynx showed marked improvement. On the 30th it was again cauterized. Since that time an exacerbation of her lung trouble has prevented her return to the clinic. At the present time she is making very satisfactory progress at the Sanatorium.

This case is reported to show that a sinusitis may cause a laryngitis and pharyngitis, which in a tuberculous patient might be diagnosed as a tuberculous process by one less experienced. It also emphasizes one of the points in the making of a diagnosis, namely that of time.

18. Sister M.B. f alt 23. Patient was referred to the office on account of hoarseness. She had an excellent family history. Three years ago she had an attack of hoarse-
ness lasting for two weeks. One year ago she had a similar attack lasting for two days. In April 1914 she had another attack longer than any of the previous ones, amounting to aphonia. At that time she was hoarse and coughed. Examination of the lungs by a local physician was negative, and he believed the case to be one of primary laryngeal tuberculosis. On November 23, 1914, examination showed a bad pair of tonsils and chronic pharyngitis. At this time there was no definite sign of tuberculosis of the larynx. A week later tubercle bacilli were found in the sputum in large numbers. March 22, 1915, an examination of the larynx showed marked interarytenoid infiltration. Local applications of lactic acid fifty per cent were begun at once. March 29 the larynx was cauterized. Local applications were continued and on May 22 the interarytenoid space was again cauterized. The infiltration of the interarytenoid space has disappeared. The cords were almost normal. The voice is clear. In other words, her laryngeal condition is markedly improved. Her pulmonary condition continues grave. She is losing weight and the prognosis of her condition is grave because of her seeming lack of resistance.
CONCLUSIONS

1. Laryngeal tuberculosis is always a secondary process unless proved otherwise by a post mortem macroscopical and microscopical diagnosis.

2. It is an important complication of pulmonary tuberculosis. Its importance varies all the way from the relatively unimportant, to the position of most important.

3. The treatment of laryngeal tuberculosis has undergone radical changes in the past fifteen years. The developments in the treatment have increased the number and the percentage of cures very markedly.

4. General treatment, surgical treatment, specific tuberculin treatment, and local applications, are important individually and combined. If individually used they are important probably in the order named.

5. The percentage of cures secured by the method of treatment employed at the Iowa clinic compares very favorably with those reported by leading laryngologists and tuberculosis workers in other places.

In closing the writer wishes to thank those whose kindness and assistance have been so much aid in the study of this subject. He wishes to thank Dr. L. W. Dean for permission to study the cases reported and for kindly and helpful suggestions. To Doctors Scarborough and Runyon of Oakdale thanks are due for assistance in securing the pulmonary condition of the cases reported.
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