Tuberculosis of the larynx

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TUBERCULOSIS OF THE LARYNX

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TUBERCULOSIS OF THE LARYNX

Tuberculosis of the larynx has long been regarded as one of the gravest complications of pulmonary tuberculosis. It is of especial interest to the laryngologist in that he is the one that is looked to for the treatment of this phase of the disease and because experience has shown that with proper procedure the gloomy prognosis of the past when this complication has arisen is not necessarily as dark as has been painted. The frequency of its appearance in connection with pulmonary tuberculosis makes it of all the more importance, worthy of careful study and well directed effort in order that the organism may be relieved of this additional focus of infection in its battle with the primary focus of infection in the lungs or elsewhere.

It shall be the purpose of this paper to consider rather briefly the different aspects of the disease and to deal more at length with the treatment of the disease as it has been studied here and elsewhere.

Definition

Laryngeal tuberculosis is a specific infection caused by the tubercle bacillus presenting in the same form the conditions produced by it elsewhere in the body, namely, inflammation, infiltration, tubercle formation, fibrosis or caseation, and ulceration. (1)
Etiology

It is probable that tuberculosis of the larynx is much more frequent than was formerly supposed. The incidents of its appearance in pulmonary tuberculosis being estimated with a wide variation. Fetterolf (2) in a careful postmortem study of 100 cases dying of pulmonary tuberculosis reports 83 cases had gross tuberculous lesions with probably a higher percentage if the microscopic findings were taken into consideration. Osler(3) gives 18 to 30 per cent. Willigh(5) estimates 13 per cent. Shaeffer(5) 97 per cent. Dennis (4) states that a routine examination of laryngeal patients would reveal many unsuspected cases. St. Clair Thompson (6) in a study of 693 sanitorium cases found 25.6 per cent with laryngeal complications. At Oakdale Sanitorium (1) with a careful supervision of the larynx cases by the staff at the Sanatorium and at Iowa, the percentage is gradually growing higher, especially since the more advanced cases are now being cared for as well as the insipient ones at that institution. The life of the institution to April 1, 1915, was 8 years and 9 months (1). with a total of 1,912 cases admitted. During the first four years out of 611 cases 7 were diagnosed as having laryngeal trouble which probably did not represent the number having this complication. During the next five years 1,301 cases were admitted and 196 cases, or 15.6 per cent were diagnosed, and 111 cases of simple chronic laryngitis which may have been
in part tuberculous as the patients for a large part do not remain there long enough to have the diagnosis changed. It is generally agreed, however, that there are many cases of non-tuberculous laryngitis in tuberculous subjects however.

In the year 1915-1916 of 315 cases at Oakdale there were 60 cases diagnosed as having laryngeal tuberculosis, or 19.04 per cent. This is accounted for by the fact that the Sanatorium now cares for all stages of the disease.

Many other studies of the incidents of laryngeal involvement in pulmonary tuberculosis, as Lamberson (7) in a study of 244 of pulmonary tuberculosis gives 45 per cent as having tuberculous laryngitis and 21 per cent simple laryngitis. The high percentage of the latter being due perhaps to the fact that (1) "The Laryngologist deems it better when in doubt to diagnose the case as simple laryngitis because of the graver prognosis in the mind of the patient.

Levy (8) in a report of 338 pulmonary tuberculosis cases gives 83 in the first stage of laryngeal involvement, 170 in the second stage, and 85 in the third; tending to show a fact (1) largely regarded by laryngologists and tuberculosis specialists that the laryngeal involvement increases in frequency with the advance of the lung condition up to a certain point, and again decreases as the most advanced cases are studied.
Lockard (10) states that in a series of 14 reports from all parts of the world an average of 34.5 per cent of cases of pulmonary tuberculosis shows laryngeal involvement, which is a fair estimate although the inclusion of incipient cases through the medium of systematic examination of all phthisical cases without awaiting development of symptoms referable to the throat would without question materially increase this percentage. He states that a lamentable tendency to neglect routine laryngoscopic examination in even many of the most up to date sanitoriums exists, and probably is accountable in large measure for the popular misconception that tuberculous laryngitis is an uncommon complication. The fact that many sanitoriums refuse to admit cases with advanced laryngeal lesions also tends to make reports from such institutions show an artificially low percentage of the complication.

Age

The age of the individual appears to exercise a strong influence on the disease, and according to the statistic (10) it is most common between the 20th and 40th years. In Lockard (10) cases the average has been toward the lower limit giving allowance however, for some of the institutions with which he is connected which admit only patients of about the lower age limit as given. A table by Lake (10) shows that the proportion of consumptives attacked by tuberculous laryngitis increases.
up to the above age period and then steadily declines.

Wide extremes are of course occasionally met with, varying from the age of 12 months to 76 years. The percentage of cases in the young may found to be larger due to the fact that the direct examination of the larynx in children is becoming more frequent, but owing to the fact that pulmonary tuberculosis runs a severe and rapid course in the young this is problematical.

Sex

At Oakdale the incidents of the complication was found to be about equal (1). According to Wright and Smith (9) males are affected in proportion of 71 per cent to 29 per cent in females. According to statistics tabulated by Lockhard (10) the proportion varies from three to one as in males to females, to about equal proportion in his own experience. A large number of cases were considered inclusive of sex limited institutions of both classes.

Occupation

Vocation aside from unhealthfulness of surroundings and habits and the fact that masculine occupations are taken into consideration plays little or no part in the involvement of the larynx. In Lake's tables (10) a small percentage of singers, vaudeville artists, etc. contracted the laryngeal complication, although affected by pulmonary trouble. According to Lockhard also, a
small percentage of patients of similar occupation
presented laryngeal trouble in comparison with patients
in other modes of life in which the misuse of the larynx
was the exception. Thus the fact that practically all
singers and fakirs of the class living under unhygienic
circumstances, usually suffering from chronic laryngitis,
are not necessarily, if stricken with pulmonary involve-
ment, liable to the laryngeal complication.

If tuberculous laryngitis occurred as a primary
manifestation of the disease, one would expect to find
a large proportion of the above chronic laryngitis
cases whose vocations entail undue exposure to contagion,
independent, of the practically always present pulmonary
contagion.

Tobacco and Alcohol

Tobacco and alcohol according to statistics obtain-
able do not appear to have any appreciable influence
except in so far as the general condition is involved.

Previous Local Disease

Previous local disease is probably a factor which
must be given due consideration in that any process which
may tend to break down the barrier formed by the healthy
tissues to the tubercle bacillus and form a portal of en-
try, is a possible point of tubercle invasion. One of
the commonest causes may be syphilis. Lockhard (10)
says "a source of impaired resistance in the larynx
may be an active, an old, or presumably cured lesion, which weakens the part so that it is susceptible to attacks which would otherwise prove impotent.*

Acute laryngitis may predispose to the accession of local tuberculosis, but if properly combatted is not greatly to be feared unless frequently recurrent.

Chronic laryngitis, as in the case of chronic laryngitis in occupational disorders, is difficult to prove as an influence to contagion.

Nationality

Nationality apparently has no bearing on the involvement of the larynx (10).

Pregnancy

Due to the congestion of the larynx during this period there may result dissemination of a focus to the larynx or the more rapid progress of a small already existent focus. According to Dworetsky (14) anything that tends to cause congestion and chronic catarrhal inflammation of the larynx is a predisposing factor in laryngeal tuberculosis.

Mode of Infection.

A vast amount of work has been done on this phase of the complication. It still appears to be a rather unsettled question. The pathologists usually contend that infection comes through the implantation through an abrasion of bacilli from the tubercle laden sputum;
and the clinicians contend that the infection is usually haemotogenous or lymphogenous. Neither school claims the factor advocated by it to be the exclusive one, and thus it becomes a question of determining which factor is active in the greatest number of instances.

That primary tuberculosis of the larynx does exist according to theory and pathological findings seems probable and there are many cases reported. But it can only be proven on the autopsy table, and in such cases an allowance must often be made for a focus which has been overlooked. Also, although at autopsy if the lungs are found to be absolutely free from tuberculous foci there is still a possibility of infection by way of the lymphatic glands.

"It is well accepted that latent tuberculosis of any of the constituent parts of the lymphatic system particularly of the tonsils, the bronchial glands, may exist for years without symptoms or alterations in the microscopic images, and yet from such foci through lymphatic or blood transmission, or perhaps by direct transmission through tissue spaces a secondary laryngeal focus might become established; particularly if the involved gland has been subject to traumatism or to the action of such inflammatory processes as scarlet fever and measles. That such a nidus even when situated within the gland may become a point of departure for other widely disseminated processes has been repeatedly demonstrated."
Lockhard states that from a pure practical standpoint, that is from a prognostic and therapeutic point of view, a tuberculous larynx may be considered primary when there is no demonstrable evidence of pulmonary or other organic involvement. But while theoretical considerations point to the possibility or even probability of such an occurrence (for there is no special peculiarity of the laryngeal mucosa or secretions to prevent it from becoming infected) we have as yet no indisputable evidence to establish it as an abstract fact. He concludes that a) the absence of pulmonary disease does not establish the primary nature of tuberculous laryngeal disease; b) the lymphatic involvement, especially the tonsils and cervical glands must likewise be excluded; c) the tonsils are tuberculous in perhaps 5 per cent of the cases in which hypertrophy exists; d) it is found in normal sized tonsils as well as hyperplastic; e) the dependence of some laryngeal cases upon disease of the tonsils and cervical glands has been clinically demonstrated; f) Infection of the lymphatics usually follows in the direction of the lymph current, but may spread in a direction opposite or vertical to it; g) it may travel through tissue spaces; h) but few cases are recorded substantiated by post mortem examination in which lesions of the larynx the lungs have been found normal, and in many of these instances no reference was made to the lymphatic system; i) there is no inherent peculiarity of the laryngeal mucosa or secretions to prevent it
from being primarily infected; j) this occurrence,-
however, has not been demonstrated despite the fact that
phthisis is a most common and widespread of all laryngeal
diseases; k) from a standpoint of practice the larynx
may be considered primarily infected if there is no
demonstrable disease in the lungs; l) until a case of
laryngeal phthisis unaccompanied by either pulmonary
or lymphatic disease has been proven the assumption of
primary infection cannot be maintained.

Many cases of primary tuberculosis of the larynx have
been reported and some of these followed through to a
careful post mortem conclusion. Other men of large ex­
perience report that they have never seen a case. Thus
the matter narrows down to an interpretation of the term,
as to whether it implies primary as to the lungs or in
the body.

The report of a case Steiner (1) is the only one of
primary tuberculosis of the larynx that appears plausible.

It then appears that laryngeal tuberculosis is to
be considered for practical purposes as secondary to a
focus elsewhere in the body, and the manner of infection
will next be considered.

Is the infection endogenous or exogenous? This
subject also entails great difference of opinion and the
writer will simply endeavor to submit the main arguments
in favor of each of the two modes of infection. The
theory of endogenous infection is based on the findings
that a) the laryngeal process is usually the most marked
upon the side when pulmonary disease is fartherest advanced or in unilateral pulmonary involvement, the laryngeal infection is in a majority of instances on the affected side (many observers however, deny this).

The histological findings tend to show that the infection is endogenous as the first macroscopical alteration in laryngeal tuberculosis are points of more or less circumscribed swelling, covered by healthy mucous membrane.

Histologically these swellings are found to be subepithelial tubercles, the epithelium itself and an intervening zone of varying thickness remaining entirely normal. The distribution of the bacilli corresponds closely to the arrangement of the infiltration tissues, decreasing in number from within out and entirely dissappearing as the epithelial layer is reached.

It is well known that the tubercle bacilli gains entrance to the lung by the blood stream from the alimentary tract in the large majority of cases, and the presence of many tubercle bacilli in the lymph stream is shown by the many caseated lymph nodes in tuberculous patients. This with bacilli in the blood and lymph streams in large numbers, an intact epithelium covering the larynx, altho' the resistance of the part is greatly lowered by the cough and toxins present; what is more natural than to suppose that the bacilli often find favorable sites for growth.

Many objections are advanced to the above arguments of endogenous infection by other writers who advance the theory of exogenous infections as follows:

1. Laryngeal tuberculosis is usually secondary to pulmonary tuberculosis and comes on usually when the pulmonary pro-
cess is well under way and the presence of the bacilli in the sputum in large numbers can be demonstrated.

2. It has been proved experimentally that tubercle bacilli may penetrate normal mucous membrane and even lymph glands without leaving a trace of their entrance or passage.

3. Certain segments of the larynx are subject to irritation and erosion and it is these segments which usually become previously affected. The vocal cords for instance, owing to their exposed position and the absence of ciliated epithelium, are almost constantly covered with tenacious pulmonary secretions, while the points at which the sputum meets the most resistance during expulsion, as the arytenoid commissure, the posterior insertion of the cords and the inner surfaces of the arytenoid cartilages, seem to escape early infection. (11).

Orth gives a clean exposition of the theory of exogenous infection by means of a break in the mucosa. The so called ulcers due to action of secretions on normal or abraded mucosa.

"When we have to deal with a typical case, where perhaps there is only a large ulcerated cavity in one apex; when all the bronchi thru which this secretion must pass during expectoration are full of ulcers; when we find swollen ulcers only on that side of the main bronchus and lower portion of the trachea which from position of the body must come in close contact with the secretion, and which are found to increase in size and frequency as we ascend; when, omitting a part of the trachea, a tuberculous affection is seen to be more extensive, whenever the walls of the air passage are approximated and sputum is therefore forced against the sides - the conclusion seems inevitable that sputum constitutes the vehicle by which the tubercular toxin is conveyed
from the cavity and deposited during its transit through the air passages on favorable regions of mucous membrane. A point against the above, however, is that breaks or ulcers in the mucosa resulting from this form of infection are comparatively rare and differ both anatomically and clinically from the true tuberculous ulcer, and, while practically always tuberculous they may be purely catarrhal. Thus it would appear that the above theories cannot be wholly reconcilable and it is probable that both result in secondary infection of the larynx with the endogenous mode more prevalent.

Pathology.

The macroscopical picture may present many different aspects and on this phase of the subject there is little variation of opinion. The early appearance of the larynx may be one of hyperaemia with oedema or anaemia depending upon whether or no blood vessels are constricted by the infiltration in the sub-epithelial space. The thickening of the epithelium and the posterior surface of the larynx may at first give an anaemic appearance. Kyle 12 and others regard anaemia as being present early. In many cases hyperaemia and oedema of the arytenoids and cords are found.

Microscopically the usual tuberculous pathology is found namely, infiltration (round-celled), ulceration, tuberculomata, miliary tubercles. The macroscopical appearance of the larynx will be considered more in detail under the symptoms and signs of the disease.

Fetterolf (2) in a careful post mortem study of
one hundred cases dying of pulmonary tuberculosis gives the following as to location and character of the gross pathology present in the larynx.

The pathology deals with the gross appearance of the larynx to be studied later microscopically. He studied sixty-eight males, thirty-two females (due to the fact Phipps Institute of the University of Pennsylvania had accommodation for twice as many males as females). The larynx was involved in one hundred cases, eighty-three had gross tuberculous lesions thirteen showed absence of lesions, four were doubtful. Probably the actual percentage of tuberculous pathology in the larynx is higher in these cases because only the gross findings were recorded.

Areas involved:

1. epiglottis: tuberculosis 59
   non-tuberculous 37
   doubtful 4

The lesions varied from infiltration, and infiltration with superficial ulceration, in thirty-nine cases, to various combinations of deeper ulceration and infiltration and tuberculomas in twenty cases.

2. aryteno-epiglottic folds:

   tuberculosis 58
   non-tuberculous 42
   doubtful none

Of these the lesions consisted of infiltration only in twenty-seven, infiltration with edema in twenty-two. There were nine with superficial deep ulceration combined with edema and deep ulceration.
3, ventricular bands: tuberculous 42
non-tuberculous 57
doubtful 1

The lesions consisted of infiltration in eighteen cases, infiltration with superficial ulceration in eleven cases, the balance being superficial and deep ulceration.

4, vocal cords: tuberculous 49
non-tuberculous 51

Of these ten showed infiltration, eighteen superficial ulceration, the balance a combination of infiltration with superficial or deep ulceration.

5, arytenoid cartilages: tuberculous 57
non-tuberculous 43

Forty-four of these showed infiltration, the pathology of the balance consisted of infiltration with superficial and deep ulceration, and simple deep ulceration.

6, inter arytenoid space: tuberculous 51
non-tuberculous 49

Of these there was infiltration in forty-seven cases, superficial ulceration in two cases.

**Remarks.**

Epiglottis: One-half of the cases dying of pulmonary tuberculosis need relief for pain on swallowing. Different forms of lesions are really different stages of tuberculous invasion. Infiltration is manifested in post mortem as thickening, in life by congestion. The author says that pallor is rarely, if ever, seen in diseased parts of tuberculous larynges
uninvaded larynges may be pale in cachectic tuberculous patients). Both halves of the epiglottis are usually involved. Infiltration may extend to the margins or center.

Infiltration with superficial ulceration is a later stage, both sides are involved, ulcers may vary from one to many. The location may be to the upper edge and laryngeal surface or it may be any place, especially parts exposed to air, food, and sputum streams. The most extreme trouble is usually in the midline. There are many combinations of the above including, in some cases, infiltration, superficial and deep ulceration, usually with infiltration and thickening is perhaps superficial ulceration of the free portion, and deep ulceration of the cushion. In some cases there were large portions of epiglottis tissue with or without cartilage sloughed away. There may be tuberculomata - in some cases large enough to interfere with respiration.

Aryteno-epiglottic folds: Here the pathology is usually bilateral extending from the epiglottis in more advanced cases. The lesions consist mainly of infiltration with edema, or there may be sub-mucous tuberculomata, and hypertrophy of the cartilages of Wrisberg. Ulcers are infrequent.

Ventricular bands: The pathology is usually bilateral and these structures become involved later in the disease. The lesions consist mainly of infiltration rarely with edema, superficial or deep ulceration. We nearly always find the entire larynx involved when we find these structures diseased.
Vocal cords: These are usually both involved, a small percentage being found diseased on one side. Combinations of infiltration, with various other pathology is very common here. More extensive pathology may be found on one cord, than on the other, and the most extensive lesions usually are found at the vocal process of the arytenoid. Usually the adductor margin is affected.

Arytenoid cartilages: These are practically always involved bilaterally although involvement may be greater on one side. The pathology of simple infiltration is the commonest, the cartilages may be very large and are usually part of a general hypertrophies and involvement of the upper ring and may cause the patient little trouble. Edema is present in about twenty-five percent of the cases and may be slight or extensive. There may be a combination of ulceration and edema to a various extent, although this is less common.

Inter arytenoid space: This was involved in about fifty percent of the cases, infiltration being present as a rule although usually not extensive. There may be extensive masses protruding between and above the vocal cords, or the posterior commissure may be the seat of a small abscess (sub-mucous), or there may be superficial ulcerations difficult to diagnose grossly in this location at post mortem.
Barr (17) of Nice, favors division of the macroscopic pathology into two divisions proved by Krause under the subheads:

First, Infiltrating ulcerating forms.
Second, Slow, evolving, hypertrophied forms, that show no tendency to ulcerate.

**Symptoms and Signs:**

This phase of the subject may well be taken up under two headings, namely, the subjective and objective.

**Subjective symptoms:** The subjective symptoms of laryngial tuberculosis are many and vary according to the extent of involvement, and there has been no clear cut subjective picture of laryngial tuberculosis demonstrated. There may be many distressing symptoms with an early involvement of the larynx in some cases, while in others the disease may be far advanced and cause the patient no great amount of inconvenience.

The early symptoms as a rule closely resemble those of the simple laryngitis. That is, slight huskiness of voice, tickling sensation of the throat with perhaps a polaesthesia causing the frequent clearing of the throat, or there may be a slight ineffectual cough. The voice may be simply weak with a tendency, as the patient expresses it, of "tiring easily". In conjunction with this there are usually the signs of pulmonary involvement with the history suggestive of tuberculous disease. The general symptoms thus evidenced by anaemia, dyspepsia, loss of weight, appetite, strength, fever in the afternoon and evening with morning remissions, night sweats, haemoptysis, pleurisy, etc.
All variations and combinations of the above are possible in the early picture so that as in certain rare cases the general subjective symptoms are slight with marked laryngial symptoms and in other cases, more commonly seen, the opposite is found. As a more advanced stage of the disease is reached the symptoms become more marked as a rule. According to Osler (3), the "huskiness is peculiar and suggestive". According to Briggs (16) the huskiness goes on to hoarseness or even complete aphonia. The symptom of voice weakness after prolonged use, with a sense of laryngial discomfort, becomes more pronounced according to Lockhard (10) and is due in his judgment, to a muscular weakness resulting from the anaemia or lessened respiratory power in certain pulmonary segments.

Aphonia may be present early, even without laryngial involvement. This is due to pressure by tuberculous, bronchial, or tracheal glands or pleuritic exudates and adhesions involving the recurrent laryngial nerves.

There may marked paraesthesias as expressions of nerve perversion and lowered vitality described by the patient as a feeling of retained foreign body, resulting in a tickling, scratching sensation in the larynx or one of accessive dryness. These sensations are usually referred to the pharynx or larynx and are provocative of spasmodic attacks of an explosive or shallow hacking cough, usually dry, but in some cases resulting in expectoration or a slight amount of frothy mucous.

The symptoms due to specific cell infiltration become more marked and their character depends largely upon the location and extent of the lesion. Contrary to common medical opinion the condition of the voice may be very slightly indicative of
the nature and progress of the lesion in the larynx. "Thus in many cases of advanced and wide spread extrinsic involvement the purity of the voice remains almost unimpaired throughout the entire course of the disease, while on the other hand moderate infiltration of the arytenoid cartilages of the arytenoid space may lead to complete aphonia" (10). Likewise with dysphagia, a small shallow ulcer of the epiglottis or aryteno epiglottidean folds sometimes produces sever and lasting pain, and yet wide spread ulceration and infiltration of the vocal cords produces little pain whatsoever. As a general rule it may be said that extrinsic lesions produce pain and that intrinsic involvement causes disturbances of phonation.

"The typical tuberculous voice is weak, dull, muffled and inflexible progressing gradually to a more or less complete aphonia" (10). As has been above stated, however, the character of the voice depends on the location of the pathology. A cough is nearly always present varying from a dry, hacking ineffectual affair in the earlier stages, to a looser, easier, more frequent one as the disease becomes farther advanced. How much of this cough is due to the larynx it is difficult to estimate because of the various other causes of the same which may be present. As the effort to clear the bronchi and trachea, nasal, stomach, nervous coughs must all be taken into consideration. The secretions are not particularly increased, that is, not to sufficient extent from the larynx itself to cause great distress and laryngial bleeding is rare. Some exacerbation in the fever may be caused by breaking down of new areas or extension of old lesions, but as a rule, unless the larynx is affected by
an acute inflammation it has little result on the temperature.

Dysphagia is one of the most marked symptoms in the more advanced cases. Dennis (4) gives pain "spontaneous or on swallowing, shooting up into the ears," as quite characteristic. Ingals (17) says that with the advance of the disease, pain on swallowing and on palpation occurs with ulceration in certain locations. (By dysphagia as used, is implied all varieties as odynophagia, dysphagia or obstructed swallowing, and entrance of foods and liquids into the larynx). In a series of nine hundred and seventy-four cases observed by Lockhard dysphagia occurred in twenty-seven and thirty-two hundreths per cent. The appearance of this symptom is always considered serious because as a rule it marks an extension of the process with involvement of deeper and more vulnerable structure and unless cared for the resulting reduction and withdrawal of food leads to rapid collapse. Dysphagia is usually a result of involvement of the upper aperture of the larynx, that is, the epiglottis or arytenoepiglottidean folds. Extensive infiltration of the posterior wall or arytenoid cartilage, and perichondritis or a parichondrial abscess also result in severe pain. In addition to the pain in the larynx there may be reflex pain on swallowing referred to the ear by the auricular branch of the vagus. Acute lancinating pain according to Lockhard (10) nearly always characterizes an outbreak of milliary tubercles. The rigidity of the muscles of the posterior wall and epiglottis, leading to imperfect closure during deglutition permits both solids and liquids to enter the larynx with a resultant violent cough and laryngial spasm. Actual destruction of tissue plays no part in
this because deglutition cannot be carried on normally with a complete removal or destruction of the epiglottis. A swallowing of fluids is often more painful than swallowing solids and is characteristic in cases where a perichondritis exists (10).

Dyspnea due to laryngeal stenosis is rare and usually only occurs in those cases where treatment has been neglected or an acute inflammation has been superadded to the chronic process. The tuberculin test may give a local reaction which is of value, but cases have been reported in which a focal reaction was obtained in carcinoma. Kenyon (18) says, "In the most advanced cases the pulmonary lesions are usually far advanced and to the symptoms caused by it are added those of a badly diseased larynx usually marked dysphagia, aphonia, and pain on palpation."

**Objective Symptoms:** Infiltration may be considered the first objective sign of laryngial tuberculosis (10). Catarrh, by many writers is considered the earliest sign but taking into account the fact of the congestion caused by the lowered vitality of the patient, cough, passages of sputum, disturbed digestion, naso-pharyngeal catarrh, etc. which predispose the patient to pulmonary tuberculosis and also predisposes the patient to chronic catarrhal laryngitis. Unless the condition can be shown to result in acute tuberculous laryngitis, which is doubtful, this condition should not be regarded as an early sign of tuberculous involvement of the larynx.

The sight of the infiltration is usually the inter-arytenoid space, and here an early diagnosis between simple catarrhal thickening and an early tuberculous infiltration is
is difficult. A localization to one side of the larynx is an aid, in such a case, in favor of the tuberculous process. Dennis, Lockhard, and others regard pallor of the mucosa a very unreliable early sign and Lockhard states that the proportion of cases where hyperaemia is predominant to anaemia is as three is to one. In far advanced cases, however, the anaemia is more frequent. The anaemia that is present is often the result of the general cachectic condition and not the result of the local tuberculous process. According to Ingals (17) the larynx itself may be either pale or of a dull red color, but the congestion is rarely of the bright color that characterizes acute, or sometimes chronic catarrhal laryngitis, and it also differs from the dull red color of most malignant affections of the organ.

In the insipient forms infiltration is usually alone present but with the advance of the process some point gives way and ulceration complicates the picture.

The miliary type is usually found in connection with the ulceration and infiltration, and the true tumor exists alone of the other forms as an uncomplicated entity (10). Casselburry (13) asserts that the tuberculomata, are, especially in the interarytenoid region, the result of the fusion of smaller tubercles and present a mamillated appearance. Ingals (17) states that an early sign of laryngeal phtisis is a peculiar thinness or atrophy of the laryngeal walls which may appear not more than one-third of one-half their normal thickness, and mentions the sluggish movement of the cords as due to involvement of the musculature of the larynx. He also has
noticed in certain cases diffused dull congestion of the cords and upper part of the larynx with a diffuse or local thickening of from twenty-five to fifty per cent, as one of the signs appearing in the first year. Dennis (4) has noticed a "thin line of mucous in the posterior commissure extending from below into the arytenoid space" (1). Taking then the infiltration as one of the earliest objective signs let us next take up its character in common location in the involvement of the larynx by a tuberculous process.

In the beginning the infiltration is most often found in the interarytenoid space as a circumscribed swelling forming a convex projection during deep inspiration. It is usually located in the mid-line, but may be found on one or both sides, in the latter case giving the middle portion a sunken or punched-out appearance. The swelling may be a broad-based, flat affair or a definite tumor-like mass, in nearly all cases presenting on its surface a greyish roughened appearance due to the breaking down of the surface epithelium. In rare cases it may take on a papillomatous aspect.

In the vocal cords the infiltrate may take on a form of a diffuse or circumscribed redness with moderate swelling strongly suggestive of a simple chronic laryngitis. The tuberculour process as before mentioned, however, usually involves one side, or one side to a greater extent than the other. There may be circumscribed infiltration most common on the vocal processes and are generally found in connection with hyperplasia of the interarytenoidal mucousa. In such cases the posterior ends of the cord are of a deep pink or red
color, somewhat uneven or notched along the free edge and rounded in form with an apparent increase in both width and thickness (10). There may be simply alteration in color, either as a redness, or loss of pearly lustre, and even this slight change limited to one cord is highly suggestive (10). There may be a slight infiltration of the anterior commissure affecting either the angle of the cords, or the region above or below it and resulting markedly in interfering with perfect adduction and phonation. As the infiltration persists reaching the central portion of the cords they assume their characteristic, cylindrical form. This swelling may assume large proportions the cords becoming several times their normal size, and as in other portions of the larynx, the surface epithelium of the cord may be quickly eroded leaving shallow ragged ulcers.

The arytenoid cartilages may also be affected unilaterally most frequently and bilaterally in many cases as the disease progresses. The process here consists of infiltration showing as a swelling of deep red or purplish color the extremities of which extend upward and outward until lost in the aryepiglottic folds. If the infiltration is of long standing the mucousa becomes pale and transluscent. Movement of the cords are mechanically hindered by the enlarged cartilage as well as by ankylosis of the crico-arytenoid joint. There is usually more or less edema present about the cartilages and along the usually infiltrated aryepiglottidian fold which tends in some cases, where the swelling is marked, to close off the entrance to the larynx resulting in a marked dyspnoea and dysphagia.
The epiglottis is usually affected later and in the milder cases presents an appearance of being thickened, with the edges slightly rolled on themselves, bright red or pale in color. In more advanced cases it may be greatly swollen assuming the characteristic turban shape, with either slight or extensive ulceration and destruction. As has been before noted, severe pain is practically always associated with epiglottic involvement and slight infiltration destroys its mobility. A considerable percentage of cases show involvement of the ventricular bands and this may be the sight of first localization in the larynx. As a rule it is of moderate extent but may reach large proportions.

Sub-glottic infiltration of the larynx are rare and this point is useful in a differentiation in other laryngeal lesions.

It may be noted here that in the opinion of Lockhard, Ingalls and others the pale swollen parts of the larynx often mistaken for edema are usually more or less firm and solid in consistency.

Ulceration usually follows the infiltration in the more advanced cases and is characteristic in appearance. It results from a disentigration of caseated tubercles and the first changes occur in the subendothelial tissues. The ulcer characteristic of sputal infection has ill defined margins, irregular and uneven, the so called quotation "worm eaten" appearance. The presence of granulation and miliary tubercles are frequently noted. The edges are occasionally prominent and overlap and obscure the base, hence the true size and limit of the ulcer.
can not always be definitely determined. There are usually found small red granulations upon the floor and around the margins of the ulcer and Lockhard gives the small greyish or yellowish spots known as the miliary tuberels, as being pathognomonic of tuberculous lesions. The base is usually covered with a yellowish or dirty white exudate of pus and epithelial cells. Ingals (17) describes the ulcers as being superficial, one to two mm. deep with worm eaten edges and irregular yellowish grey surfaces. He states that the ulceration usually begins at the ventricular bands and soon involve the opposite side, the posterior commissure, and the true cords. It is significant that in tuberculous ulceration the process usually begins at the lower part of the larynx, while in syphilis it is apt to start at the epiglottis (17). The most frequent site of ulceration according to Lockhard is, the vocal cords, interarytenoid sulcus, arytenoid cartilages and epiglottis. They may occur, however, on all segments of the larynx. It seems reasonable that the type of ulcer should vary with the underlying tissues as segments rich in glands and covered by cylindrical epithelium shows ulceration deeper and more crater-like in form than in areas where it involves tissue covered by pavement epithelium. Extension occurs through confluence of contiguous ulcers and the slow superficial extension of individual areas. Erosion ulcers may be present in the larynx of tuberculous patients and demonstrate their nature by their rapid healing under local treatment, but the tendency is for these early to become infected with tubercle bacilli and run a consequently stubborn course.

Ulceration in the interarytenoid space posterior wall, is a commonly observed site of election. The first change is
gradual greyish or blueish discoloration of the convex boarder, giving way to form deep clefts, presenting the so called "saw toothed" appearance, or it may present a punched out appearance. The base shows numerous red granulations, which may in turn ulcerate and become surrounding by new granulations. In some cases these being so numerous as to suggest papillomata, and in others becoming edematous and nearly filling the glottis.

Ulceration of the vocal cords vary in characteristics according to their location upon the cords, namely, the free edge, upper and lower surfaces, and they may occur on corresponding edges of both cords. Along the free edge they may present one or more necrotic areas or may involve the whole edge of the cord in one slough. The entire upper surface of the cord may be involved converting it into a series of longitudinal folds and ulcers of the interior surface are usually not recognized until the accompanying granulations project beyond the edge of the cord. The ulcers may be of a great variety of forms, round, irregular, or oval. Ulceration of the epiglottis is usually found on the laryngial surface, but the free edge is also frequently attacked. The ulceration may be superficial or deep, the latter resulting in marked distortion of the organ. Instances of the free edge or one-half of the organ being destroyed are numerous, and defects as V-shaped incisures, etc. are frequently seen. Primary ulceration of the lingual surface is rare. The ulceration is usually secondary to other involvement of the larynx but may be primary and there have been cases noted in which perforation of the organ was found.

The ventricular bands are usually ulcerated in conjunction with other segments of the larynx and practically all forms
of ulceration may occur here. According to Lockhard the most frequent variety of ulceration in this location is that of a flat, round, superficial diffuse variety, with a white base that bears a striking resemblance to the necrosis of diphtheria or that due to the use of concentrated silver solutions. Severe swelling usually accompanies deep ulceration. Ulceration of the arytenoid especially the inner surface is frequent and early (12) and often leads to perichondritis and chondritis. The arypepiglottic folds are often, late, the site of large, flat, superficial ulcers and in some cases the cartilages and folds, due to ulceration, edema, and granulation lose all semblance of their normal appearance. The ulceration is rarely subglottic, but may extend down into the trachea. Cicatricial bands are rare and few authors have noted their appearance. The tuberculosis taken as a growth resembling a tumor, in the larynx, is of comparative frequent appearance. It is usually secondary but may precede a demonstrable pulmonary lesion and according to some authors shows a predilection for individuals of an age considerably younger than that at which other tuberculous lesions are want to occur. They attack all parts of the larynx being the most common in the ventricles, upon the posterior wall, and under the angle of the glottis. They may be round, oval, oblong, lobulated, pedunculated, and in color form a reddish grey to yellowish mass. They may exist singly or in clusters, varying in size from pin heads to cherries or hickory nuts, and in texture, friable, firm, or tough. The overlying mucousa is usually normal, but may be smooth or warty. They are usually
slow in development and the diagnosis is difficult in the absence of other lesions, without a microscopical section.

The miliary tubercle is very rare and its occurrence is denied by many authors. When present they appear as minute, grey or yellow nodules upon the base, or around the edges of ulcers. Heinz claims that they are invisible macroscopically even when fresh ulceration are removed and examined post mortem. Lockhard reports three cases of undoubted miliary tuberculosis of the larynx in which the tubercles were plainly visible.

Levy (8) in summarizing the objective appearance of tuberculous laryngitis gives first, localized or asymmetrical and persistent redness; second, localized or asymmetrical swelling; third, superficial erosions surrounded by an irregular rugous swelling, at what Casselbury (13) calls the vocal angle, namely, the internal aspect of arytenoid at the junction of the posterior extremity of the vocal band. Later the turban shaped epiglottis, pear shaped arytenoids, irregular infiltration and posterior commissure with the characteristic ulceration makes the diagnosis comparative simple.

**Diagnosis:** The diagnosis of laryngeal tuberculosis is simple in typical cases, but in certain incipient cases, or typical cases without constitutional or demonstrable pulmonary manifestations, and uncommon mixed types as syphilis, carcinoma, and tuberculosis it may be exceedingly difficult or even impracticable (12). According to Holinger (20) the diagnosis is usually not difficult. The subjective symptoms being pronounced, the objective findings present, especially the posterior infiltration being valuable in differentiation from carcinoma and syphilis, it being in favor
of tuberculosis. He advocates the Von Pirquet, Wasserman, and subcutaneous tests in addition to microscopical examination of tissue in doubtful cases like the above.

In direct diagnosis the subjective symptoms may be slight or prominent, consisting of dryness, tickling in the throat, a voice that tires easily, huskiness, progressing to aphonia, dysphagia, a racking ineffectual cough, etc., as mentioned under subjective symptoms of the disease, and accompanied by objective findings as considered previously in rational proportion. With the above present in a given case a definite diagnosis may be easily arrived at.

In order that the diagnosis may be made at the earliest possible moment and in order to give the patient the maximum benefit of treatment the early signs should be carefully considered and all cases of chronic laryngitis in tuberculous patients should be kept under close observation.

Tuberculosis of the larynx must be differentiated then from chronic catarrhal laryngitis, syphilitic laryngitis, lupus, cancer, pachydermia, prolapse of the ventricle, and leprosy.

As has been above mentioned the differentiation in chronic laryngitis in a tuberculous patient may be very difficult and only carefully, frequent observation will enable the observer to detect the first real signs of a tuberculous invasion. According to Lockhard the thickening of the posterior wall in simple acute or chronic laryngitis is generally less extensive, does not show the same marked convexity during phonation, is less translucent in appearance, and is usually smooth in contrast to the rougher
and more uneven infiltration of tuberculosis. In certain cases, however, variations from the usual picture may be found and under cauterization the non-tuberculous exudates promptly recede.

Syphilitic infiltration of the posterior wall may give a picture identical with that due to tuberculosis and the diagnosis must depend upon the history, the further course of the disease, and the therapeudic test. The Wasserman test has been positive in carcinoma and tuberculosis and microscopically it is often difficult to differentiate. Two cases cited by Albright (1) demonstrate this. It is extremely rare (10), however, for any of these diseases to be limited to the sulcus without associating lesions of other structures.

When pachydermia is limited to the interarytenoid mucosa, and shows irregular outgrowths, microspical examination will alone show the true nature of the process.

New growths of the posterior wall are extremely rare and can only be differentiated from the fullness of tuberculosis by microscopical examination of excised tissue.

In further regard to chronic catarrhal laryngitis it may be said that this is usual bilatteral, while tuberculosis is unilatteral or more marked to one side, and if associated with unilatteral pulmonary tuberculosis of the same side the diagnosis is clinched. The cough is usually more severe in tuberculous laryngitis due to infiltration of subendothelial structure. Early paralysis points to tuberculosis or malignancy. Simple catarrh is tractable to treatment while tuberculosis of the larynx is not. True ulcers never form in simple laryngitis although there may be superficial erosions.
In pachydermia involving vocal processes the picture is pathognomonic (12). Upon one cord there is a broad base circumscribed excrescence and upon the corresponding portion of the opposite cord a depression into which the former fits. The only condition approaching this in tuberculosis is an ulcer on one cord with a deep pouch and a circumscribed infiltration of the opposite cord in a corresponding location but close inspection will show the true nature of the lesion and true ulceration does not occur in pachydermia. In the latter the voice may be practically normal and in tuberculous laryngitis aphonia may be present. In pachydermia the cords are usually freely movable while in tuberculous laryngitis their motility is not infrequently impaired.

The differentiation of syphilis and tuberculosis of the larynx is as follows: As to the size of the lesion the only point of practical significance is the ulcer on the lingual surface of the epiglottis which is nearly always syphilitic.

The character of the ulcers may be very like and it is not always possible to decide between them. If miliary tubercles are found about the ulcer it, of course, clears the diagnosis. Other signs of syphilis should be looked for as old scars, perforations, etc., not overlooking the fact that tuberculosis has produced perforations of the palate and cartilaginous septum of the nose. The history is, of course, important. The presence of a pulmonary lesion is of aid and the therapeutic test is also of value but it should be borne in mind that it occasionally happens that even the tuberculous lesion will improve under such treatment but this improvement is fleeting.
and they promptly lose that which they have gained. Added to this is the Wasserman test. Demonstration microscopically of the bacilli of the tissue in tuberculous processes may be of help and tuberculin injections of value, resulting in a local reaction consisting of a hyperaemia and a rise in temperature within one to two hours usually obtained by the injection subcutaneously of 1 mg. of Koch's Old Tuberculin. No reaction with 10 mg. may be considered as excluding tuberculosis (10).

Prolapse of the ventricle may be excluded by returning the prolapses with the pressure by means of a cotton tipped applicator.

Lupus is usually secondary to disease of the skin and neighboring mucous membrane and is then easily recognized. It is very rare, runs in almost painless course, and is frequently limited to the epiglottis.

Leprosy is never limited to the larynx and the skin condition is pathognomonic. Dysphagia is usually absent. There may be hoarseness and dyspnoea.

In all doubtful cases where carcinoma is under consideration a considerable fragment should be excised cutting well into the base and examining microscopically for the characteristic features of both conditions. It should be remembered, however, that there have been cases reported in which carcinoma, tuberculosis and syphilis were all present at the same time.

Prognosis: A tentative prognosis in tuberculosis of the larynx is all that is warranted. While the majority of writers still give a gloomy prognosis the hopelessness as expressed a few years previously is giving way gradually to a more moderate view.
"Many factors must be considered aside from the extent and locale of the laryngeal process that is, pulmonic or other organic tuberculosis, occurrence of intercurrent diseases, constitutional idiosyncracies, and weaknesses, the social and financial status, the moral and physical fortitude, etc." (12).

The statistics on this phase of the subject are extensive and of little practical value for here we are dealing with a disease in which each case is a law unto itself. In many of the earlier statistics the conclusion sought for was simply the length of life after the well-marked involvement of the larynx appeared. The later writers using present day knowledge of the therapy of this complication are becoming more and more optimistic as to the prognosis which, however, taking all factors into consideration is at best not roseate for the general result, but is much improved for that of the larynx.

Solly (21) says, "Taking the results in laryngeal cases without considering the fate of the patient there were sixty-four per cent of permanent arrest of the disease, five per cent temporary arrest, in additional cases in which tissue broke down just before death. Looking at ulcerated cases alone, fifty per cent healed permanently and ten per cent temporarily".

Lake (22) in a table compiled about 1900 gave ten per cent recoveries. Schmidt (23) in a table covering the years 1888 to 1892 over 898 cases gives 18.99 per cent arrested which is exceptionally good for the earlier writers. According to Lockhard (10) a conservative estimate today would place the percentage of probable recoveries at between fifty and sixty
per cent, without taking into consideration the ultimate fate of the individual, that is, the pulmonic process, and each year the outlook grows increasingly bright notwithstanding the fact that our armamentarium has few remedies of greater efficiency than it contained a decade ago. He bases the latter of the statement on the fact that "the incipient lesions are becoming more early recognized, on more universal utilization of treatment local and constitutional and to an almost equal degree upon the mental attitude of the physician and patient. Convinced of incurability the laryngologist formerly treated throat tuberculosis in a perfunctory manner striving after the single goal of euthanasia, while today with deep appreciation of the necessity of constant vigilence and supervision with its common reward, his increased zeal and confidence bring infinitely greater results. Moreover pulmonary tuberculosis is now much more widely recognized in its earlier stages and suitable treatment, hygienic and climatic is generally instituted while there is yet good hope of eventual cure. In consequence the laryngeal complications are much rarer than formerly and more amendable to treatment when discovered."

The mental equipment of the patient is of great importance in the prognosis and his determination and perseverance in carrying out a course of treatment will do more to bring a good result from any one method of treatment (1). Albright found in the cases treated at Iowa that the patients which have been cured were the ones that had been most persistent and painstaking in their efforts.

The prognosis of the disease as a rule follows more or less that of the lungs, but proper treatment of the larynx will
be of inestimable value to the lungs in the fight against the disease and vice versa.

Freudenthal (24) states that the larynx is undoubtedly affected in a large percentage of cases and that it is obvious that many of them are cured, with or without a diagnosis, and with or without treatment. He says that "it is equally certain that a certain proportion of the milder cases get well simply by being placed in proper hygienic surroundings."

Briefly as regards the locale of the lesions in their prognostic significance may be said that, first, the most serious and obstinate lesions of laryngeal tuberculosis are those of the epiglottis, moderate involvement either in the form of shallow ulcerations or circumscribed infiltrations being more serious than extensive intrinsic disease.

Second, in point of danger, ranks general involvement of the arytenoids and aryteno-epiglottidean folds, these being late manifestations of the disease like those of the epiglottis, originating when the pulmonary and laryngial infections are far advanced and progressive.

Third, isolated ulceration or infiltration of the arytenoid cartilages are fairly responsive to treatment when the disease has not spread to the aryteno-epiglottidean folds.

Fourth, destruction of the various cartilages is of great importance both because of the local condition upon which the necrosis depends and because it is usually found in association with progressive pulmonary disease or general miliary
tuberculosis.

Fifth, circumscribed ulcerations and infiltrations of the interarytenoid space respond well to treatment. Superficial ulceration of the ventricular bands and vocal cords heal in the majority of all cases while even extensive disease of these segments, if the remaining tissues are uninvolved can usually be conquered (10).

As to the prognosis of special symptoms the voice may regain its normal tone quality and even sustaining power, but as a rule remains permanently rough and inflexible. Aphonia due to recurrent laryngeal involvement is nearly always permanent. Deep ulcerations of the cords usually produce permanent hoarseness but complete restoration is sometimes obtained after very extensive necrosis.

Dysphagia, if treated early, may be amendable to help but in advanced cases even under radical surgical treatment the result is not satisfactory. Dyspnoea due to laryngeal tuberculosis rarely advances to the point of threatened asphyxiation. It is usually slow in development and responds well to medical and surgical treatment. Miliary tuberculosis, if associated with general tuberculosis, is invariably fatal and localized miliary tuberculosis is always of grave importance. Pregnancy predisposes to tuberculosis laryngitis and will practically always cause a recurrence in healed lesions and a lighting up of incipient and quiescent cases. If the laryngeal disease is far advanced the outcome is nearly always fatal. If incipient, prompt abortion offers the only fair hope of recovery. According to Imhoffen (25) pregnancy renders the prognosis of tuberculosis
of the larynx very grave, the mortality varying from eighty-six to ninety per cent. He states that the confinement can give rise to a state of edema of the lesions of the throat or even produce dyspnoea.

Syphilis next to pregnancy is the greatest of complicating diseases. If the tuberculous lesions is in its incipiency healing may result. If advanced even if the syphilis is brought under control the tuberculous process rapidly continues.

Age at either extreme renders the prognosis grave. Spontaneous healing has been known to occur not only in cases where the pulmonary conditions were improving but in cases of rapid disintegration. A cure according to Lockhard cannot be claimed until a period of two to five years have elapsed from the time of apparent arrest, and it must admitted that these lasting cures are uncommon due to the rapid advancement of pulmonary lesions. The recurrences are the result of some insult to an encapsulated tubercle long quiescent and could be avoided by continuance after apparent cure of the careful hygienic and dietetic rules in force during the period of actual treatment. In recurrence the prognosis is usually worse than in primary attacks. A final point in the prognosis is the skill and technic of treatment on the part of the physician and in this there is a vast amount of individuality.

Treatment: As has been before mentioned a few years ago the treatment of laryngial tuberculosis was mainly palliative as the outlook was regarded as hopeless. Today a very great majority of writers assume a very different view and the surgical
treatment combined with medical and hygienic is at the forefront.

As regards the result of treatment the statistics show a gradually higher percentage of improvements and cures, as each year goes by. Albright (1) notes the following: "St. Clair Thompson (6) 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 per cent. At Oakdale the 66 cases of laryngeal tuberculosis which he lists up to April 1, 1915, show 10 discharged as cured, 15 per cent, with 36, or 54.5 per cent of the 66 improved. Mermod out of 280 cases reports 60 cured for one year, 40 for two years, 17 for three or more years, and one case cured for ten years. Lockhard reports 154 cases with epiglottidean involvement, 29 of which, 18.83 per cent, were cured."

Prophylaxis: Among the measures looking forward to the prevention of the tuberculous complications in the larynx, the rational care of predisposing influences in the upper respiratory tracts are of importance.

Gordon's (26) experience has led him to the conclusion that the larynx is not such a vulnerable part of the body and would overcome tubercle bacilli invasions from the lungs if the upper respiratory passages were normal. His experience in operating procedure upon tuberculous patients has been limited to those for correction of deformity of the nose and throat. He has seen a number of cases that were on the sanitarium waiting lists clear up, after degenerated tonsils were taken out. Deformities of the septal or turbinal bones corrected and his observations have led him to the conclusion that the larynx is not very suscep-
tible to tuberculous invasion from the lungs provided the upper respiratory passages are normal.

Freudenthal (24) believes it should be a routine procedure to examine the upper respiratory tract in every case that enters the sanatorium, whether the patient complains or not. If this is done as a routine procedure a number of pathological conditions will be found, the correction of which will have a decided beneficial effect, not only locally, but also, as regards the pulmonary condition. Many of these patients suffer from an atrophic catarrh of the nose or a milder form of this, rhinitis sicca. The mucous membrane of the nose is dried out or covered with scales and crusts, the air spaces are large enough, but the air itself cannot be assimilated. The characteristic hacking cough described in all text books as premonitory of the incipient stage of pulmonary tuberculosis often has its origin in the pharynx being caused by dried secretions of atrophic rhinitis getting into this region, or a post nasal catarrh. If these conditions are treated according to customary methods, the cough will be eliminated and in this way much can be done toward arresting the progress of the disease in the beginning. He favors the frequent cleansing of the surface of the larynx to prevent secondary infection and as an aid to the healing of ulceration and advises the irrigation of the larynx in suitable cases.

Dworetsky (14) in his service insists on the routine eye, ear, nose and throat examination after which he says he is in a position to advise the patient as to any abnormality which will have an influence on his larynx. He says that a defective
Septum causing more or less trouble is of common occurrence. A defective septum with consequent obstruction to respiration or drainage should be corrected and the modern submucous resection in the hands of the skillful rhinologist nearly always meets with success. The operation practically always can be done under a local anaesthesia with little loss of blood or shock to the patient. Many patients will be benefited by the removal of a hypertrophied middle turbinate obstructing the accessory sinuses. The inferior turbinate unless permanently hypertrophied will often regain its normal size after correction of septal abnormalities, but if not the galvano-cautery will often be of aid, without sacrificing the function of this important organ in preparing the air properly for entrance into the lung.

A coexisting pharyngitis or a nasal pharyngitis should be treated and elongated uvulas attended to. Patients with diseased tonsils and adnoids should be carefully questioned as to previous attacks of tonsilitis and if such a history be obtained they should be removed. The above procedure in preventing chronic inflammation of the larynx upon which tuberculous processes may devolve is undoubtedly of value.

In general while according to some authors they may have little predisposing effect on the laryngeal complication, alcohol and tobacco, excessive use or misuse of voice, should be avoided. Cough, unless excessive and non productive should not be disturbed, but if so, a sedatives are indicated. The use of steam inhalations is often of value. There may be an effort made to lessen the sputum, to avoid the constant bathing of the laryngeal mucosa, but this depends largely on the general condition of the patient.
In case a patient is not a fit subject for surgical procedure, which should be left to the judgment of the expert in charge of the general phase of the patient's condition, palliative measures in the upper respiratory tract as alkaline nasal washes, astringents to the pharynx and tonsils, etc., may be used. Grant (27) states that many patients date the beginning of improvement in the larynx to the time when an alkaline nasal wash such as Dobelles solution is given (1). Bucklin (28) considers the removal of a nasal obstruction sufficient to determine a cure. Of course the prophylaxis should contain the proper hygienic and dietetic treatment of the pulmonary condition best carried out in a scientific sanitarium located in a proper climate.

The treatment proper of tuberculous laryngitis will be taken up, with consideration of the following phases:

1. **Hygienic and dietetic treatment,**
2. **Medicinal treatment,**
3. **Surgical treatment,** - endolaryngeal operations,
4. **Surgical treatment,** - extralaryngeal operations.

**Hygienic and Dietetic Treatment:** Probably one of the most essential things in the treatment of tuberculosis of the larynx is that of proper hygiene and diet for without these the medicinal and surgical treatment is usually of little avail. This, of course, evolves to a greater or less extent upon the financial status of the patient, and if he be fortunate enough to be able to afford the proper surroundings and care in a modern, scientific sanitarium on whose staff there is a laryngologist of experience and judgment, his chances of recovery are infinitely greater than those of a patient whose poverty forces him to live under circumstances where even the basic rules of hygiene are wanting.
With the education of the general public, however, there are many fine institutions springing up throughout the country at public expense, at which the poorer patient may obtain adequate and proper treatment at the minimum of expense. The patient must, at the outset, be made to realize that the result of the treatment rests equally with him as to a favorable outcome and he must be ready to make sacrifices to obtain the sought for results. The inherent resistance which he possesses must be most carefully preserved and he must be prepared to faithfully cooperate with those in charge of his case.

A suitable climate is of great value in the treatment of the disease by reason of its remarkable power in arousing dormant energies and stimulating metabolism (10). The essentials aside from a variable amount of humidity in dry cases and vice versa in moist cases, are; 1, abundance and bacteriological purity of the air; 2, sunshine; 3, coolness; or in a certain number of cases warmth; 4, altitude; 5, wind; 6, equability; 7, soil.

Taking into account the bacteriological impurity in crowded cities districts and the effect of secondary infection by streptococcal and other infections in pulmonary and laryngeal lesions, it would seem only rational that the pure, thin air of our high mountains, open seas, deserts and country places could not be anything but beneficial as a hygienic measure.

Next to pure air, sunshine is of importance not only because of the warmth and powerful stimulation to the patient's spirits, but also because of the therapeutic action, which while never having been clearly explained, is of great value in this disease.
Dryness is usually of benefit to catarrhal of the mucous membrane, but there are cases in which, when extreme, the condition may be reversed. This phase, as before mentioned, must be suited to the patient in the locality chosen for him.

Equability is in very asthenic cases, or in the aged to be sought for, while in the stronger cases a moderate degree of variation is stimulating and this is not an unimportant factor.

The altitude for which most patients are suited should be of moderate degree owing to the greater purity of the air and stimulating effect on metabolism, but should be well within the scope of the patient's vitality and cardiac sufficiency. The above is of importance, because while applying more specifically to the pulmonary conditions the fact that the result of the laryngeal treatment is closely associated with that of the pulmonary makes it worthy of time and attention in choosing the most favorable measures for the latter.

The patient should be kept out of doors no matter how far advanced the condition, unless there is present a very acute inflammation or very painful lesions in which case a perfectly lighted and ventilated room of equable temperature with fairly moist atmosphere may be prescribed. According to Lockhard patients with laryngeal complications, contrary to public opinion, do best in a dry, cool climate and he says that this is especially true of the still curable cases in which we are most interested. He says, however, that in the very late advanced cases, with the extreme painful ulceration, that the moist warm climates of the southern coast are probably best, but that in such cases it is a question of eusthenasia and not of cure. He argues in favor of a high altitude in that permanent arrests occur in such climates.
in a percentage of sixty per cent to fifteen per cent from all other sections of the world. Levy (10) from a large series of cases, has reached the following conclusions:

1. "In cases in which both lung and throat lesions develop in Colorado, the throat lesion manifests itself forty-eight weeks later than those originating elsewhere. 2. In cases in which lung lesions develop elsewhere, and the throat lesion in Colorado, the throat lesion manifests itself 62.3 weeks later than in those originating elsewhere."

As regards patients with pulmonary lesions in whom the complication in the larynx has not arisen Lockhard says, "While it has been impossible to get definite statistics from many of our American sanatoria, it is almost the unanimous opinion that tuberculous infection of the larynx occurs rarely in patients who have carefully adhered to the out of door, rest, regime for a number of weeks." The discipline of a sanatorium both for the purposes of mastering the knowledge of discipline of the proper method of living and also the habit of complete vocal rest, is very essential if even only carried for a few months of the year.

The diet should in the main be that indicated in pulmonary tuberculosis but a special diet for cases in which dysphagia is marked is of interest to the laryngologist. Lockhard (10) gives a careful dietary for such cases consisting of nutritious coffee, cream lemonade, milk porridge, white of egg lemonade, etc., with also methods of feeding and one interested may find them discussed at length on pages 184 to 190 in his work on tuberculosis on the larynx.

Absolute rest of the voice is a point upon which all laryngologists agree. The influence of complete vocal rest
upon the course of the disease is not general appreciated and cannot be exaggerated. If the lesions are incipient and not progressive, moderate use of the voice may be permitted but all singing, reading aloud, prolonged conversations must be strictly enjoined. If, on the other hand, the process is moderately advanced and active, absolute rest is imperative if the best results are to be obtained. The whisper, if used, must be soft and not forced for the latter is as harmful as ordinary speech, and conversation should be carried on by writing and the finger manual. Even in the incipient cases absolute rest of voice is the one most valuable agent in the curing of these cases (10). Albright (1) reports a case of Dr. Dean's in which after absolute rest of the voice of two years the patient came back with a perfect voice and no evidence of the laryngeal involvement except a slight amount of scar tissue. Holinger (20) states that the first requirement of therapy is absolute rest of the voice. The patient is not allowed to talk a word. Great improvement and even cures have been noted from this practice alone, but precaution should be taken the psychic effect, the depression, does not become too great. In special sanatoria this is more usually and effectually done. Hill (31) says that absolute rest of voice for a period usually about six months, will result in healing many cases. Watson Williams (1) reports two cases which he considers wholly cured by faithful silence. A nasal and pharyngeal hygiene should be carefully attended to as has been discussed under the Prophylaxis of the Disease.
Medicinal Treatment:

Constitutional treatment: This phase of the treatment should not be without due consideration although the surgical treatment is given the most space by the majority of writers. Tuberculin therapy receives a prominent place with some experimentors, and a very minor one with others. Pottenger (32) of California says, "The preparation I have used for the most part is the watery extract of tubercle bacilli (Von Ruch). The larynx is the ideal location for a lesion to be treatment by tuberculin for the dosage can be controlled absolutely by the local reaction produced. The larynx should be washed daily and the dosage should not be increased beyond that which is necessary to produce a slight local reaction; nor should a second injection be given until all reaction produced by the first has disappeared. Tuberculin administered in this manner will cure many cases of tuberculous laryngitis, it will increase the change of recovery from fifty to seventy-five per cent, and in many cases will offer practically the only hope."

"Von Ruch himself claims remarkable curative powers for his preparation. Before the national association for prevention of tuberculosis he said, 'As regards the treatment of these cases (laryngeal) the great majority require no local measures whatever. Immunization with the watery extract is essential except in cases in which the infiltration has advanced to the massive stage with deep ulceration. In such cases palliative measures relieving the distressing symptoms are to be used.'" Lockhard (10).

With regard to the above Lockhard states that a considerable number of cases typifying various stages of the disease
he has tried the above treatment with absolutely negative results aside from that which might have been obtained under the best hygienic conditions and without other treatment than vocal rest, cleansing sprays, etc., which measures were enforced in every case. The great majority of laryngologists have apparently also experienced similar results and tuberculin aside from diagnostic purposes is seldom used. General medication aside from the control of the cough and sputum is little used.

Inhalations are of considerable use in allaying an associated catarrh, cleansing erosions and favoring expectoration especially after a surgical interference in the larynx. Many preparations are used in this manner especially the essential oils as, that of pine, peppermint, sandalwood, etc., or of compound tincture of benzoine. The inhalations are usually used for twenty minutes to one-half an hour and repeated at intervals varying from once daily to every two hours. Anaesthesin has been used in various preparations producing a slight local anaesthesia varying from a few minutes to two or three hours. Sprays if correctly used are not only of value in keeping the pain in subjection, but also of keeping the larynx free from mucous and pus, which is one of the essentials of successful treatment. For cleansing purposes any mild alkaline spray or mild anticeptic may be used, at intervals of from two to four hours. For dysphagia a one to five per cent cocaine solution is of value. Alypin is also used in one to ten per cent strength the constitutional effects being less than that of cocaine. The value of sprays are in proportion to the skill of the patient in their use and an occasional change of the anaesthetic variety is often of value.
Insufflations are usually used in marked cases of dysphagia and the powders as a rule applied are orthoform and anaesthin, thoroughly dusted upon the mucosa, by means of suitable tubes held in the mouth of the patient in such a manner as to insure distribution of the agent over the affected surface on inhalation.

Local application by brush of ten to twenty per cent cocaine may be used just before eating but the duration of the anaesthesia is very short and it has not been found very satisfactory. Holinger objects to morphine, cocaine, orthoform and anaesthin because of action on the heart and favors nerve blocking primarily.

Wright and Smith advocate one to ten per cent alypin for dysphagia. Dennis recommends orthoform, Grant mentions trichloracetic applied directly to the ulcers. Lake (33) recommends the application of a solution consisting of phormaline seven parts, phenol twenty parts, lactic acid fifty per cent, water to make one hundred parts. Morrie Mackenzie (34) recommends the insufflation of morphine in starch to a laduc's tube. Isambert (35) favors the use of morphine in glycerine.

The relief of pain by nerve blocking is one of the commonest used procedures of advanced cases of inoperable laryngeal tuberculosis. Eighty to Ninety per cent of alcoholis commonly used with or without a little betaeucaaine hydrochloride, one-half grain equals one ounce of alcohol. According to Head (36) "It is a procedure which requires no special apparatus or training, which is not hazardous or dangerous, which is not seriously painful, which can be repeated as often as required, which is usually successful after the first or second attempt, and which
can produce but few ontoward effects and those but temporary. In a large majority of cases pain is relieved almost instantly, swelling rendered easier, nutrition better maintained, use of opiates avoided, and natural cheerfulness and optimism of the patient greatly enhanced."

The technic of the injection has been worked out in various manners by different laryngologists and the injection may be carried out apparently with good effects in any one of several ways. E. Paul Boncour (37) proposes a method which is very simple and which eliminates the danger of piercing the vessels to which one is subject by the technic of Frey. His procedure is as follows: With a platinum needle which fits a glass syringe, the patient lying with the head in slight hyperextension, the skin in the neck is pierced at the center of the line forming the promontory of the thyroid and the convex part of the hyoid bone. The needle having been inserted vertically, after having passed the different anatomic layers of this region, strikes the thyrohyoid membrane, which at this point is a truly resisting ligament. To obtain the sensation the author withdraws the needle a few mm. and pushing it in anew, feels little by little the resistance of the membrane. The direction of the needle is then changed and is pushed horizontally outward and backward, paralleling the superior border of the thyroid cartilage about one-half of a centimeter above it, in the plane of the cleavage of the nerve formed in front and outward by the thyrohyoid muscle, and behind and internally by the membrane which is constantly resisting; and contact with which is perceived by the point of the needle. Proceeding in this way the passage of the superior laryngeal nerve is soon found after a passage of two and one-half
centimeters and the patient experiences a sharp pain radiating toward the ear of the side on which the puncture is being made. This pain is evidence that the nerve itself has been struck and at this moment the injection is made. The author claims three advantages for this method; first, numerous trials in search of the nerve are unnecessary; second, it is safe and in Boncour's opinion there is no danger of wounding the vessel; thirdly, a bilateral injection can be made through one puncture of the skin. He uses one cc. of ninety per cent alcohol at ordinary temperature. In some cases he injects previously an anaesthetic. If, in spite of this, the first injection of alcohol produces a sharp otalgia it is well to wait five to twenty seconds before continuing injection. Ordinarily he claims analgesia for ten to twenty days for this procedure. Combier (38) prefers the method of Boncour to that of Hoffman and other commonly used technics. Fernando Bertrand y Castillo (40) summed up his experiences with injections of alcohol by saying that while his results with injections of alcohol according to the technic of Hoffman were unsatisfactory, he secured good results with Boncour's method. M. Lanois (40) makes his injections directly over the nerve which is the same technic as employed by Frey. He minimizes the dangers of piercing the membrane or injuring the vessel and he uses one to two cc. of ninety per cent of alcohol with one per cent of stovaine.

The operation of amputation of the epiglottis for dysphagia will be considered under the endolaryngeal surgical treatment.

As far as medicinal treatment is concerned the one really effective procedure according to most authors is the direct application of the various pigments. They state that faulty technic is the result of so many innocuous effects under this
treatment. A special applicator is recommended by Lockhard having the advantage of sufficient strength to permit a firm pressure and "scrubbing," with enough elasticity to prevent the possibility of making surface abrasions. The pigments commonly used are lactic acid, formalin, ichthyol, resorcine, guaiacol, pyoktanin, argyrol, and nargol, phenol, para-mono-chlor-phenol, and iodine vasogen. Lactic acid has been used first as a medicinal agent in the larynx since the work of Kraus in 1885 showing on the cadaver healed tuberculous lesions when this agent was used during life. In the lesions of an ulcerative type it has but one equal, formalin, but unlike the latter is valueless in cases with intact epithelium. Solutions of from twenty per cent to full pharmacopeial strength are used, at intervals of about seven days. The ulcerated areas should be anaesthetized and in nonulcerated areas the lesion must be converted into an open wound. For best effect the application must be made directly and carefully to the affected area by aid of the mirror, or better still by the direct method.

Formalin, if anything, seems better than lactic acid in tuberculous laryngitis in that it is effective in every type of lesion in a degree equal to, if not better, than any other agent. It differs from lactic acid in that it causes comparatively little pain and reaction. It may be applied daily or thrice weekly in a strength varying from three to ten per cent. It is strongly antiseptic in weak solutions and therefore is of value as a prophylactic.

The silver salts, nargol, argyrol, protargol, one to twenty per cent are of service in the pre-tuberculous stage, creating little influence after the ulcers have set in or in cases
with marked tumefaction.

The above are commonly used while the following are recommended by some authors, namely, ichthyol and resorcin ten to twenty per cent in nonulcerative lesions; guaiacol and creosote one to ten per cent, pyoktanin on ulcers, para-mono-chlor-phenol, ten to twenty per cent as a caustic in ulcerative or infiltrative lesions, iodine-vasogen ten per cent in beginning infiltration, and painful swellings about the arytenoid joints. Many other remedies have been tried and recommended, among them gold cantharidin two and five-tenths per cent, aqueous solution injected intravenously (41). Scarlet red ten per cent has been recommended with varying results (42).

Intra-tracheal injections by means of the intra-tracheal syringe is of value in combating cough and removing distressing tickling in the throat and supra-sternal notch.

Sub-mucous injections are rarely used as the penetrating pigments accomplish the same results more effectually and painlessly.

X rays: Much has been written on this subject but the large majority of writers have been disappointed in its use. Radium has been used in a few cases but so far as the writer has been able to discover the results so far have been largely negative. Sunlight and arc light have, according to Lockhard, produced nothing worthy of note in the treatment of tuberculosis of the larynx and he saw several cases receiving direct sunlight treatment with reflected rays, etc. thirty minutes to two hours daily with no apparent results.

Surgical Treatment: Surgical treatment as developed up to the present day seems to be coming more and more to the front as
the rational treatment for tuberculosis of the larynx, bearing in mind always that the method and effect of its use is to be determined by the condition of the patient and the nature of the lesions to be treated. Any lack of unison on this subject among laryngologists seems to be more in regard to the method of procedure used, than to the advisability of its use. There are still some, however, especially men who are dealing with the pulmonary condition, believing that the laryngeal complication goes hand in hand with the pulmonary, who would refrain altogether from active surgical influence.

The object of any form of treatment in tuberculous laryngitis is fibrosis and it is obvious that if this can be accomplished quickly, without causing from the procedure used, damage to the lungs and general strength, it is of value. The treatment which most fully meets the above requirement, when intelligently and skillfully used, is that of surgery, combined, of course, with proper post-operative treatment. The two problems which present themselves to the laryngologists are first, the relief of pain; and second, the cure or temporary arrest of the disease. "In the former condition little or no attention may be paid to the general condition of the patient aside from his ability to withstand the shock of operation and the operator is confronted by a single problem which concerns the probable degree of relief to be anticipated. In general, radical extirpation or division of the involved tissues will produce more or less complete relief from dysphagia, more lasting and effective than it is possible to obtain from any other system of treatment. Even though the requisite operation shortened life they would still be indicated, but in practice they are
found to prolong it, and most remarkable cures occasionally result even in apparently hopeless cases." (10). If a cure is to be attempted the indications and contraindications must be given due consideration and the following rules are generally applicable, 1, the lesions must be surgically incipient, that is they must be accessible and fairly well circumscribed. (A seemingly localized lesion is usually surrounded by more or less infiltration which extends farther than the laryngeal image indicates and here the clinical and pathological judgment of the operator comes into play). Widespread infiltrations and ulcerations associated with high temperature and dyspnoea are absolute contraindications, but the rule cannot be held to apply to those advanced cases that have resisted all other treatment. 2. The lesion must be accessible. Occasional barriers to thorough endolaryngeal curettage are found in such conditions as the narrow and distorted larynx, a rigid or laterally compressed epiglottis, an unfavorable location of the lesion, an excessive irritability, uncontrolled by cocaine, when any attempt at manipulation is provocative of violent attacks of coughing and retching. 3. Pulmonary lesions must be either incipient or quiescent. If advanced and rapidly progressive, surgical work is usually inadvisable unless, as before stated, the lesions have proved resistant to other treatment or when they are the cause of severe and otherwise unconquerable pain. 4. Extensive operations should not be performed upon one with organic tuberculosis other than pulmonary. 5. Patients who show a marked reaction to cocaine, that is, cardiac weakness, fever, insomnia and loss of appetite, should not be subjected to secondary operations unless some of the newer, non-poisonous anaesthetics are effective.
In an individual who meets all the above requirements early and complete removal of all diseased tissues is always indicated, provided a fair trial of simpler treatment has been unavailing made. The use of cutting instruments is far preferable to electric cauterization or electrolysis. The latter may supplement but should rarely supplant the former and the reaction from galvo-cauterization is fully as great as from the cutting operations and a dozen applications as a rule will not accomplish more than one fearless removal of tissues. They may be well used following the latter, however, and sometimes in small, beginning, well localized processes, primarily.

Operations: The endolaryngeal operations commonly used are, 1, incision and scarification; 2, curettage and excision; 3, galvano-cauterization; and 4, electrolysis.

Incision and scarification is a form of treatment little used at present. It was introduced by Moritz Schmidt who has, to a large extent, abandoned it in his work. The technic of incision is simply that of incising the laryngeopharyngeal wall, down to and including the interarytenoid incisure, with a pair of angular scissors. Twenty per cent cocaine anesthesia is usually used, rectal feeding is used for three or four days following the operation, and dysphagia is usually relieved in cases of extensive infiltration of the posterior wall and it is in these cases that it has been most commonly used. In edema scarification causes considerable shrinking with a corresponding decrease of subjective symptoms. Either a single, deep linear incision or multiple punctures can be made.

Curettage and excision. Since the work of Arnoldson in 1913 advocating intralaryngeal excision of tuberculous foci
and amputation of the epiglottis, this form of treatment, which although used to a certain extent, came rapidly to the front. We discussed the series of thirty-four selected cases of six hundred cases of laryngeal tuberculosis he treated in this manner and came to the following conclusions regarding this form of treatment:

1. Medicinal local treatment of laryngeal tuberculosis has no real effect on the course of the disease.

2. Surgical endolaryngeal treatment, is on the whole, without danger. One need not fear wound infection, aspiration pneumonia, or haemorrhage.

3. Endolaryngeal excision, including amputation of the epiglottis, has the peculiar advantage that functional improvement ensues quickly. So there is added the possibility of a pathologic examination. Surgical treatment should be combined with rational, local measures.

4. Partial or total endolaryngeal excision of tuberculous vocal cords may in single cases give a good result producing improvement of voice and a clinical cure.

5. Spontaneous cure or improvement may occur in a small number of especially favorable cases of laryngeal tuberculosis but this by no means justifies the neglect of rational local treatment.

6. Emphasis must be placed on the general hygienic and dietetic care combined with rational active local treatment in tuberculosis sanatoria.

The above represents practically in its entirety the general opinion of the leading laryngologists today and is the idea which is most commonly followed.
The indication for the use of curettage and excision are according to Lockhard (10):

For **curettage**:

1. Removal of friable granulations and tumors.
2. Removal of sharply circumscribed infiltrations.
3. Stimulation and cleansing of sluggish ulcers.

For **excision**:

1. Removal of circumscribed or not too diffuse infiltrations of the epiglottis, ventricular bands, the posterior wall, and aryepiglottic folds.
2. Ulceration of the epiglottis, ary-epiglottic folds, and arytenoid cartilages accompanied by severe dysphagia.
3. All cases of infiltration and granulations which because of their consistency cannot be removed by the single curette.

Arnoldson (1) gives as his compiled indications for operation, as well from his own extensive experience, the following:

1. Diffuse infiltrating types with tendency to deep ulceration (perichondritis) if wide-spread with diffuse infiltration can be helped in no other way, than by surgery (excision of tumors and cautery of their surfaces) with hope of limiting the process and preventing stenosis.

2. Tumors and polypi that cause either dyspnoea 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 a 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 extensive excision should be incised. He favors the amputation of the epiglottis as a palliative as well as a healing measure.

Contraindications (1):

1. Advanced pulmonary tuberculosis, complicated by fever and cachexia.

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

3. Miliary tuberculosis of the larynx and pharynx.

4. Excessively nervous patients with little resistance. The above hold true, of course, only to a limited extent, and as the severity of the laryngeal symptoms progress the question of procedure must be left to the judgment and experience of the operator.

Technic of Currettment and Excision:

1. Anaesthesia: Local cocaine, twenty per cent, and from one to three thousand to one to ten thousand adrenaline anaesthesia is most commonly used and is that followed at Iowa clinic.
The addition of morphine and atropine administered one-half hour before operation tends to lessen the excitability of nervous patients and dry up excessive secretions in the mouth and throat. At Iowa the patient is given one-fourth grain morphine sulphate and one-thousand of a grain atropine one-half hour before operation. The pharynx and larynx are brushed with twenty per cent cocaine solution and and one to three thousand adrenaline, starting one-half hour before operation followed in a few minutes by a direct application of twenty per cent cocaine and one to three thousand adrenaline on a swab of cotton on a Becks applicator, the swab being held directly in the upper part of the larynx, using the forefinger as a guide. This is repeated at intervals of ten minutes for two more doses until all reflex irrit. and mobility is destroyed.

Various other methods of anaesthesia are advocated including proprietary analgesics and submucous injections but the above has always given entire satisfaction here and is most commonly used elsewhere although the method of procedure may vary slightly in different institutions. The use of scopomine and morphine as used in some clinics, especially when the suspension method of laryngoscopy is used, never has been found necessary here, nor has a general anaesthetic of any kind.

The preliminary cleansing of the larynx, except for removal of mucous and pus, before operation, is unnecessary, and if used purely gratuitous, for a cough immediately before or during operation renders the larynx as septic as if preliminary cleansing had been entirely omitted.

The choice of instruments may be left entirely to the judgment and pleasure of the operator as they are too many and
varied for mention here. Many operators devise instruments to meet their own needs and the style of curette or biting forceps used may be any one which in the judgment of the operator is most easily handled and accomplishes the desired result quickly and thoroughly.

For exposure of the larynx for operation either the indirect method with a mirror, the direct method by means of the electric lighted laryngeal spatula or any of the modifications of the Killian suspension method may be used, the latter, however, presenting the most approved method for the majority of cases.

The indirect method of operating in the larynx is rapidly going into disuse because of the faults which the invention of the direct laryngoscopy overcame, namely, the element of personal equation both as to patient and doctor, hours of throat education, tolerance for anaesthesia, especially local, and the peculiar physical phenomena that present at the last moment to defeat the through, exact, and sometimes delicate and trying procedure in the larynx.

The use of the laryngeal spatula is of value in medicinal applications where exactness and care is necessary beyond that capable of accomplishment by the indirect method and in cauterization following the use of the biting forceps and curette. For thorough operative work in the larynx the suspension method should be used for the following reasons:

1. A better exposure of the larynx is obtained by this method than by any other.

2. More rapid, thorough, exact work can be accomplished and fewer sittings are required.

3. When proper technic is used it entails little more hardship on the patient than by the direct method and the post
operative effects are no greater.

4. It enables the operator to use both hands in his work and at the same time the larynx is immobile and not changing in position.

5. It is of great value for demonstration purposes, (at Iowa the entire section of students and assistants can, without trouble view the pathology in the case both before and after operation and a limited number observe the operative procedure).

6. As regards tuberculous laryngitis, according to many eminent laryngologists as Killian (44), Jackson (45), Levy (46), Lynch (47), Bruenings, Ingals, Freudenthal and many others, it is the exposure of choice.

7. By reason of better exposure early lesions are more clearly and easily seen and attacked.

8. Its execution is as simple if not simpler than direct laryngoscopy.

A brief description of the apparatus, technic and uses in tuberculous laryngitis by Killian, "The father of suspension laryngoscopy" follows:

The apparatus consists of a tongue spatula, suspension hook, mouth gag, counter presser, gallows, operating table, and shield. The tongue spatula is gutter-shaped and fitted with movable wings to prevent the tongue from bulging too much at the sides. This spatula may reach to the region of the cords or carry a second one for lifting the epiglottis out of the way. The suspension hook is attached to the tongue spatula and there is a screw present to adjust the point of suspension to a point directly perpendicular over the end of the tongue spatula or even in front of it, in this manner preventing it from slipping out. The mouth gag is adjusted by a screw to hold the mouth
widely open. The gag is formed by a bow, which is fitted to the lower part of the spatula hook and can be screwed up or down. The counter presser may or may not be used and its purpose is to bring the anterior commissure into view by pressure on the cricoid region. The gallows consist of a right angled bar screwed to the operating table, adjustable backward and forward, up and down. The operating table may be made higher or lower and in certain patterns can be regulated by the operator by a crank mechanism while seated in front of the patient. A head rest used by some operators obviates assistance. Light may be obtained by that reflected from a head mirror or a small electric light at the end of the spatula. When adjusted the operator can observe at a glance the larynx, pharynx, and mouth cavity. The immediate neighborhood of the larynx projects more plainly, the pyroform sinuses gap, the arytenoid region comes forward from the vertebral column,

All patients are not suited anatomically for this method especially the short necked, very heavy patients, with prominent teeth but for the large majority this method of exposure is admirably suited.

Technic: Introduce the tongue spatula under good illumination with the mouth widely open up to the epiglottis and then over this deep into the inner part of the larynx. The mouth gag is next correctly inserted and the hook suspended on the gallows. A few turns of the wing screw on the hook bring into view at once the finer parts of the interior of the larynx.

Used in adults in tuberculous laryngitis all granulations can be removed at one sitting and with punch or curette all infiltration taken away. If necessary the cautery may be
employed deeply. The treatment of even advanced cases is materially shortened and the patients can soon after removal of the grossest changes be sent to sanatoria for further treatment. Should edema occur after the operative interference it is easily controlled by Albrecht's hot-air apparatus or by steam inhalations.

There are many modifications of the Killian apparatus and the one used at Iowa clinic being that of Lynch which possesses the advantages of having greater rigidity and strength, obviates the use of a secondary spatula for the epiglottis as in the Killian, and has a better arrangement of tooth plates in the mouth piece.

The patient then being suspended, and a clear field obtained for work, the infiltrated tissue is radically attacked with double or single currette and the diseased tissue thoroughly removed in as far as is advisable. Thoroughness is absolutely essential and a second operation is permissible, if necessary, as soon as the reaction consequent upon the preceding operation has subsided.

The writer will not attempt to go into detail here, upon the various surgical procedures as related to the pathology presenting in the larynx, except to say that as far as a curative treatment is concerned, the lesions as noted in "Indications for surgical treatment" should be early and radically obliterated.

Possibility of malignancy should be considered in cases where the diagnosis is in doubt and before attempting radical procedure a piece of tissue should be submitted for pathological examination. Arnoldson regards the subglottic location of
pathology as sufficient evidence of its nontuberculous nature as to prevent any attempts at its removal.

Post-operative treatment: This is accomplished in many ways, each operator usually following a course somewhat of his own, but all resembling more or less each other in the essentials.

1. Immediately following a radical extirpation of tissue the patient is placed in bed with an Albrecht hot-air apparatus at the neck or a steam tent is used for varying number of hours to avoid extreme reaction with edema.

2. Following this the patient returns to his hygienic, dietetic, local, medical treatment accompanied by careful observations until such a time as further recurrence shall again necessitate operative procedure.

The practice here has been after diagnosis to at once remove the pathology after a manner above described, a croup tent being used for twelve hours following operation, the patient kept under observation for about forty-eight hours, then dismissed to a sanatorium where a treatment of rest of voice, fifty per cent lactic acid, or one to two per cent formalin application, steam inhalation for twenty minutes every two hours with general hygienic and dietetic treatment is carried out. The patient is examined daily by the interin at the sanatorium and weekly by the chief of staff at the university hospital as to the progress of the case. Small recrudescences and sluggish areas being cauterized or curretted if occurring.

Galvano-cauterization: This has an important though extremely limited field of usefulness. The lesions to which it
is particularly adapted are dense, firm infiltrations of the ventricular bands, anterior commissure of the cords, and subglottic region. It is of occasional service in promoting cicatrizition of unduly sluggish ulcers, although for this purpose the currette is more generally applicable and effective. Owing to the bleeding in cutting away the ventricular bands the cautery is also used here. The cautery as used is usually a platinum point, heated to a dull red by the electric current and must be buried deeply in the tissues penetrating as nearly as is possible to the base of the lesion and the number of punctures depending on the extent of the involvement. Its use at Iowa is mainly confined to the cauterization of small beginning, interarytenoid tumors and the bases of larger tuberculomata removed by the punch. Edema rarely occurs, and there is no danger of after infection and the pain is not severe. There are, as in all other forms of treatment of laryngeal tuberculosis, many clinicians who choose the cautery in its variable forms to the practical exclusion of all other forms of surgical treatment.

**Electrolysis:** This has never become popular owing to the uncertainty of its results and the fact that it apparently possesses no advantages over the true surgical procedures at its best.

**Fulgaration:** Freudenthal (49) has given this form of treatment a prominent place. He connects a high frequency current to a wire covered by a hard or soft rubber and bent to suit the individual larynx. The current is operated by a foot switch, the sparks being visible to the operator and several applications of a few seconds each are made at one sitting. He sums up the benefits saying:
1. There is a mild caustic effect which destroys the ulcer or infiltration.

2. One need not be so careful as with galvano-cautery in trying to hit a certain point, which occasionally is difficult. Always direct the sparks toward the affected spot though, of course, they spread all over the larynx.

3. An added advantage is the ozone produced by the current.

4. The ease of administration makes it of preference.

5. There is no danger of edema, the reaction being slight.

**Extra-laryngeal Operations:** Tracheaotomy, intubation, larynxo-fissure, thyrotomy, laryngectomy, are only of use in advanced, desperate cases, and in such may tend to prolong life to a slight extent or produce a moderate amount of eusthanasia, but owing to their seriousness should not be considered an ordinary treatment.
The following are some of the cases that have been treated in the Iowa Clinic, with the results of that treatment given in abstract. Some are cured. Some have gone out, from observation, and other 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, a simple, easy, but not a very scientific classification. In addition to Turban's classification is the practice at Oakdale to place all cases having any complication of the pulmonary in the Turban III class.

Turban 0:- 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.

An additional classification that is used at Oakdale is as follows:

1. Incipient (favorable)

   Slight initial lesion in the form of infiltration limited to the apex or a small part of one lobe.

   No tuberculous complications. Slight or no constitutional symptoms (particularly including gastric or in-
testinal disturbance or rapid loss of weight.)

Slight or no elevation of temperature or acceleration of pulse at any time during the twenty-four hours, especially after rest.

Expectoration usually small in amount or absent.

Tubercle bacilli may be present or absent.

2. Moderately Advanced.

No marked impairment of function either local or constitutional.

Localized consolidation moderate in extent with little or no evidence of destruction of tissue.

No disseminated fibroid deposits.

No serious complications.

3. Far Advanced.

Marked impairment of function, local and constitutional.

Localized consolidation intense:

Disseminated areas softening:

Serious complications.

Case I. Mr. C. age 35. Patient was last well Oct. 31, 1913. His first pulmonary symptom was that of haemorrhage followed shortly after by hoarsness. Before admission he complained of fatigue, insomnia, loss of weight, loss of strength, stomach trouble, cough, sputum, fever, night sweats, pain in the chest. On admission to Oakdale his condition was diagnosed as Far Advanced, Tuberculosis III of probably four years duration with the general condition unfavorable. He was admitted to Iowa Clinic on July 21, 1915, complaining of throat trouble. He had also been treated at this Clinic during the preceding year. He had an extensive tuberculous involvement of the larynx with
marked involvement of the interarytnoid space and true cords. He was treated by means of the actual cautery at intervals of about two weeks, with 50% lactic acid, steam inhalations, rest of voice at the Sanatarium, in the meantime. Starting about three months after he was operated by the suspension method and the involved tissue was thoroughly eradicated by means of the Punch and currette. This was then followed by treatment as before operation. The larynx rapidly improved following this operation for about two months when a second similar operation was necessitated by the return of extensive tuberculous involvement of the true cords and interarytnoid space. A very thorough eradication was done at this time and the larynx continued to improve up to the date of dismissal, requiring only one addition dispersion before the patient left the hospital. The patient now returns at intervals of about four weeks for examination of his throat and at the present writing it shows very slight tuberculous involvement.

This then was a case which for a long time had been treated by the use of the cautery and which under the radical treatment using the suspension method made a rapid recovery.

Case II. Mrs. C. age 34. Patient was last well seven years ago and her trouble followed pneumonia and a severe pleurisy. Following this she presented all of the common symptoms of the advanced pulmonary tuberculosis and in addition laryngeal symptoms. She entered Oakdale July 30, 1915, with the pulmonary condition far advanced. Turban III. Right III. Left I. Her trouble was apparently of about fourteen years duration with the general condition unfavorable, digestion impaired, and larynx involved. She entered the Iowa Clinic in October and a diagnosis
was made of tuberculous laryngitis with extensive involvement of the interarytenoid space. She was treated by means of the cautery for about one month followed as usual by the steam, lactic acid, rest of voice, treatment at the Sanatarium. Following this the process was attacked by means of the punch and curette under the suspension method which was not necessary a second time. Four months following this the patient was discharged with the larynx practically cured and her general condition much improved. The usual lactic acid, steam, etc. treatment was of course followed out after the suspension operation.

This then was a case in which the suspension method was used almost immediately and for which there was no necessity of a repetition.

Case III. Miss. D. age 18. First noticed trouble about nine months before admission with an onset of a cold on the lungs, sore throat, temperature, sputum, loss of weight, etc. On admission to Oakdale she was classified as an insipient case with slight involvement of the right lung probably of about three months duration. About five months after months admission she was referred to Iowa Clinic because of throat trouble. She gave a history at the Clinic of chronic hoarsness, worse in the winter and when she had a cold and accompanied by some pain on swallowing. She catches cold easily, has a chronic nasal discharge, and frontal headaches worse when she has a cold. She complains of some pain at times in her left ear in which she had a chronic discharge when a child. On examination she was found to have considerable nasal trouble and a tuberculous involvement of the interarytenoid space. The nasal trouble was corrected and active treatment started at once in the larynx. This consisted of cautery-
ization followed by the usual treatment at the Sanatarium. One month after admission the larynx not responding to cauterization she was suspended and the infiltrated tissue removed by means of the punch and currette. The above operation was repeated twice at intervals of one month and on her discharge five months after admission the larynx was practically well. Her general condition at this time was much improved and she was discharged from Oakdale.

This is a case where the laryngeal trouble evidently followed a chronic laryngitis secondary to disease of the accessory nasal sinuses and which responded remarkably well to the radical treatment.

Case IV. Miss M. age 24. Entered Oakdale in Nov. 19, 1915. She was admitted to Iowa Clinic Dec. 8, 1915. She has noticed hoarsness at irregular intervals for one and one-half years. She has had no pain and no other symptoms than hoarseness. On examination the larynx showed slight infiltration at the vocal angle and interarytenoid space. This case was started on the lactic acid, steam inhalation, rest of voice treatment and was kept under close observation until February 9, 1916. The progress up to this time showed very little improvement. On February 25th she was operated by the punch and currette method, and on March 29th the larynx was noted as being practically well. At this writing she is still under the medicinal and Sanatarium treatment. There was no recurrence two months following the operation. The general condition is rapidly improving.

This was a case in which the involvement was cared for very early and correspondingly quick improvement followed a radical procedure.
Case V. Mrs. M. age 42. Was last perfectly well two years ago, and first noticed cough and hoarseness. Entered Oakdale on Dec. 22, 1915 with condition far advanced. Turban III. Right III. Left II. The general condition favorable. Previous to admission she had all the usual symptoms of advanced pulmonary tuberculosis. She entered Iowa Clinic on Feb. 9, 1916. Had been at Oakdale seven weeks. She complained of spells of hoarseness for the previous three years with intervals of complete aphonia. No dysphagia. Examination showed marked edema of the arytenoids and infiltration of the vocal angle. On Feb. 23rd the throat was getting rapidly worse. On the 25th a suspension punch and currette operation was done. This was followed by much swelling. She was put on the usual treatment at the Sanitarium and returned for cauterization on March 10th. On March 29th the larynx was doing well, and much of the inflammation and infiltration had disappeared. On May 24th the left arytenoid was again considerably enlarged and was again operated by means of the suspension punch and currette. At the present writing the infiltration has practically subsided and the larynx is rapidly resuming a normal appearance.

This is a case which in five months time has closely approached a cure.

Case VI. Miss P. Age 22. Came to Iowa Clinic on Nov. 10, 1915. She complains of hoarseness of about a year's duration and accompanied by some pain on swallowing during the week before admission. Examination showed the vocal cords reddened and swollen with infiltration of the interarytenoid space and slight enlargement of the epiglottis. The case was diagnosed as tuberculous laryngitis and on Nov. 24th the larynx was curretted under the suspension method and she was put on the customary
post-operative treatment. She continued this treatment up to Feb. 9th 1916 at which time she was discharged from Oakdale and her laryngeal condition was pronounced as nearly well. She was advised to continue the same treatment and report at the Clinic at six week intervals for inspection. When last seen the larynx was apparently completely healed.

Case VII. Mrs. P. age 35. Was last perfectly well about four years ago. She presented the usual tuberculous history and was admitted to Oakdale on Feb. 1, 1916. Her condition was moderately advanced with involvement of Turban III. Right I. Left III. She entered the Iowa Clinic on Mar. 1, 1916 complaining of nose trouble. She gave a history of frequent colds, copious anterior and posterior nasal discharge, frontal headaches, dysphagia, hoarsness, and occasional pain in the ears. On examination she was found to have a chronic pansinusitis and an empyema of the right antrum, and tuberculosis of the larynx with interarytenoid edema and infiltration. On Mar 3rd. the actual cautery was used in the interarytenoid space suspension method and the patient withstood the operation well. She was put on the customary treatment at the Sanatarium. On April 24th the larynx was thoroughly curretted under the suspension method which was followed by marked reaction. The larynx improved rapidly following this although a secondary similar operation was necessary the following month. The infiltration and inflammation in the larynx is still present with slight ulceration in the interarytenoid space but considerably less in extent than on admission. The patient is being cauterized at present at two week intervals and is gradually improving, the Sanatarium treatment being still carried out.

This case was rather obstinate in its response to the
radical treatment but considering the time of four months in which the case has been treated is making very fair progress and should ultimately present a cure unless the pulmonary condition should interfere in the meantime.

Case VIII. Mr. P. age 24. First noticed trouble in June 1915 consisting of pain in chest, anorexia, cough, fever, etc., and was admitted to Oakdale Jan. 10, 1916. Condition moderately advanced Turban II. Right III. Left II. General condition favorable. He was admitted to Iowa Clinic on Feb. 9, 1916 complaining of chronic hoarsness for about two or three months following the onset of his pulmonary trouble which cleared for a time but has recurred at intervals since. The examination showed tuberculous laryngitis with considerable involvement of the interarytenoid space. He was immediately started on the medicinal treatment at the Sanatarium and the interarytenoid was cauterized on Mar. 3rd, using the suspension method of exposure. He continued with the medicinal treatment to the larynx and the subsequent cauterizations until April 5th when the larynx was thoroughly curretted. This was followed by deep cauterization on May 31st which was accompanied by a very marked reaction but with corresponding improvement after about two weeks. At the present time cauterization is used about every two weeks to the interarytenoid space and false cords with medicinal treatment to the larynx in the meantime. At present the condition of the larynx is showing improvement.

This was a case in which the radical treatment is being combined with the cautery to good effect especially after the major portion of the pathology has been radically removed. The case is still under treatment.
Case IX. Mrs. Y. age 38. Admitted to Oakdale on Dec. 1, 1914. She was apparently well up to Feb. 1914. First trouble appeared as hoarseness, dyspnea, temperature, and night sweats. She was diagnosed as far advanced Turban III. Right III. Left II. impaired digestion, general condition unfavorable. She appeared at Iowa Clinic in May 1914 and underwent a long course of cauteries and medicinal treatment for tuberculous laryngitis up to June 25, 1915. At this time the larynx was operated by the suspension method with the punch and curette and on July 14, 1915 the condition was much improved. The larynx was cauterized at intervals of two weeks until Aug. 27, 1915 when a large tuberculoma was removed from the interarytenoid space. The medicinal treatment was then continued until Sept. 22, 1915 when examination showed that the larynx was apparently perfectly well. The patient returned on Mar. 16, 1916 and reported that she had had no trouble with her throat. Her general condition was quiescent. The last note shows no swelling about the arytenoids and a slight fold of the mucous membrane over the cords which is probably scar tissue. No sign of tubercle or trouble in the larynx. Scar tissue no abundant.

This is a case which after a long course of treatment with cautery and medicinal applications rapidly reached a complete cure after the combined treatment of the radical extirpation of the pathology combined with the cautery and medicinal treatment.

Case X. Mr. W. age 42. Entered Oakdale on Dec. 8, 1914. His condition was pronounced far advanced Right III. Left 0. of about nine years duration. The prognosis was unfavorable. He gives a history characteristic of pulmonary tuberculosis. He entered Iowa Clinic on May 14, 1914 and was diagnosed tuberculous laryngitis.
laryngitis. Cautery and medicinal treatment was started. A short
time following this he developed an acute suppurative otitis media
and a mastoidectomy was done on the right side. The larynx gradu­
ally but very slowly improved up to Sept. 20, 1915. At this time
the interarytenoid space was attacked by the suspension method
and the interarytenoid space cleaned out with punch and currette.
On Oct. 6 the larynx was working exceptionally well. He was
cauterized at intervals up to Dec. 8 at which a small tubercle
appeared in the right vocal angle, which was removed on Dec. 31
by the suspension method. He was discharged from Oakdale on
Jan. 8, 1916 and on leaving the Clinic his larynx was pronounced
practically cured. He is to place himself under a physician's
observation and to continue his medicinal treatment.

This case is another example of one which was making
slow progress by the cautery and medicinal method of treatment
which cleared up rapidly when the radical treatment is instituted.

Case XI. Mrs. M. age 28. Admitted to Oakdale Oct. 1, 1915. Case was pronounced far advanced Turban III Right III.
Left. II with about four years duration. She came to Iowa Clinic
on Dec. 1, 1915 complaining of throat and ear trouble. She gave
a history of excessive hoarsness of a years duration accompanied
at times by pain on swallowing and also a chronic discharge from
the left ear since scarlet fever at the age of eight. A left
mastoidectomy was done four years previous to admission. Still
slight discharge from the left ear. Her case was diagnosed as
tuberculous laryngitis and she was suspended on December 8, 1915
and a large tuberculoma in the interarytenoid space was removed
after which the arytenoid angles were thoroughly curretted. The
patient was under observation until Feb. 9, 1916 when she de­
volved extensive pelvic complication and passed out of our
service. At last observation on this date there was little or no recurrence at the operated areas and the larynx presented an appearance closely approaching normal.

This case was one which was improving remarkably rapidly and should have reached a complete cure if the pelvic trouble had not supervened.

Case XII. Mr. F. age 35. Admitted to Oakdale on Mar. 8, 1916. His general condition insipient involvement was Turban I. Right I. Left I. General condition favorable, digestion unimpaired. He was admitted to Iowa Clinic on April 5, 1915. He complained of throat trouble consisting of hoarseness at intervals for about one year never accompanied by pain on swallowing or complete loss of voice. Diagnosis was tuberculosis of the larynx with extensive interarytenoid infiltration. The interarytenoid space was thoroughly curretted on April 10, 1916, the medicinal treatment having been started at the Sanatorium. He is continuing on the above treatment at the Sanatorium at present and there has been no necessity for the repetition of the operation. His throat is rapidly approaching the normal in appearance and he reports for observation every two weeks.

This was a favorable case taken early all pathology possible removed at one sitting and which is apparently progressing rapidly to a complete recovery.

Case XIII. Miss G. age 22. Admitted to Oakdale Dec. 10, 1915. Her condition was far advanced involvement of Turban III. Right III. Left I. duration of about ten years. General condition unfavorable, digestion impaired. Patient was admitted to Iowa Clinic on Feb. 2, 1916 complaining of throat trouble. She gives a history of hoarseness of five months duration never progressing to complete aphonia and never accompanied by pain.
Her case was diagnosed as tuberculous laryngitis involving the false cords and vocal angle, and the usual treatment was started at the sanatarium. She was cauterized deeply by the suspension method and showed a very marked reaction. Two weeks following the larynx presented a fine appearance the infiltration and swelling having considerably subsided. She has been continued on the medicinal treatment without further operative interference up to the present time and is gradually improving.

This case was one which because of the far advanced general condition and the excessive reaction following operative interference was not attacked by the radical method but nevertheless shows gradual improvement although not as rapid as that which usually follows the more extensive operation.

Case. XIV. Miss J. Age 21. Admitted to Oakdale June 15, 1915. Condition far advanced involvement Turban III, Right III, Left II, duration two years, general condition unfavorable, digestion impaired, pelvic complications. The patient was admitted to Iowa Clinic on Nov. 3, 1915, complaining of throat trouble. Gives history of attacks of hoarsness, short in duration, during the past year taking in the throat, excess secretion in the throat, weak voice, catches cold easily, chronic nasal discharge. Acute tonsilitis on several occasions. Her case was diagnosed tuberculous laryngitis. She was started at once on steam, rest of voice, and lactic acid, and was cauterized on Nov. 12th. The medicinal treatment was continued and she was cauterized at intervals of about two weeks, until Feb. 25, when she was suspended and the infiltrated tissue removed with curette and punch. This was followed by considerable adema for a few days, which however rapidly cleared up. The cautery was again
used at two week intervals until April 12, 1916, when she was again suspended and the balance of the infiltration removed. On May 17th the larynx was pronounced practically well and she was discharged to return for observation at three week intervals.

This was a case average in character which ran a rather stubborn course when treated by the cautery, but rapidly cleared up after two radical extirpations at intervals of one month.

Case XV. Mrs. K. age 58. Admitted to Oakdale Jan. 25, 1916. Condition far advanced, involvement Turban III. Right III. Left III. Duration four years, general condition unfavorable, digestion unimpaired. She entered the clinic on Feb. 9, 1916 complaining of throat trouble. She stated that in August she first began to lose her voice, she did not have a cold, and there was no pain on using her voice. Since then she has had recurring spells of hoarseness which are gradually getting worse and more severe. Constant tendency to clear her throat, but no disphasia. The case was diagnosed tuberculous laryngitis with interarytenoid infiltration. Steam, lactic acid, rest of voice, started at Sanatarium. On Feb. 16 there was an ulcer present on the posterior end of the right cord. On the 25th she was suspended and the pathology removed by punch and curretted in the interarytenoid space. On Mar. 1 the tubercle was reported well removed. On the 10th the interarytenoid was again curretted and a punch was performed on April 12. The medicinal treatment was continued in the interval. The throat was reported on June 28th as doing very well with very slight infiltration still present in the vocal angle. Patient is still under treatment. Throat much improved.

Case XVI. Miss S. age 27. Admitted to Oakdale Oct.
18, 1914. Condition on admission was unfavorable, Turban III. Right II. Left III. far advanced, twelve years duration, complicated by intestinal tuberculosis and tape worm. She was admitted to Iowa Clinic Jan. 28, 1915 complaining of throat trouble. Complained of recurrent attacks of hoarseness, excess secretion, dysphagia, and was diagnosed tuberculous laryngitis. She was treated by means of the cautery and medicinal applications until June 25, 1915 when the larynx was operated by the punch and curette method under suspension. She continued with cauterizations and medicinal treatments until Aug. 17 when she was again suspended and interarytenoid space and interarytenoid cartilages well stripped of infiltrated tissue. She was again curedtted on Sept. 22, Nov. 19, with deep cauterizations of the arytenoid cartilages in the meantime. The larynx continued slowly to improve even following the radical treatment, and there was a marked tendency for tubercle formation to recur in the interarytenoid space and the arytenoid cartilages were obstinately edematous. The larynx in general, however, was much improved since admission. The patient left the Clinic and Oakdale on Jan. 26 and has not returned, so the ultimate result is not known. Condition on discharge larynx improved, general condition unimproved.

This case was one of the most obstinate which was treated in the clinic, and the slow progress may be partially traced to the fact that the patient intractible, refused to cooperate in the treatment, and appear at times when surgery would have prevented the extension of beginning infiltration. She was dismissed from the Sanatarium of Oakdale for breaches in discipline. This case well illustrates that even where radical measures are used the utmost co-operation of the patient in all
phases of the treatment is essential.

Case XVII. Mr. T. age 35. Admitted to Oakdale Feb. 15, 1915. Condition far advanced, involvement Turban III. Right III. Left II. duration five years, general condition unfavorable, digestion impaired. Admitted to Iowa Clinic on April 26, 1916 complaining of chronic hoarseness at intervals during the past two years. No dysphagia, or aphonia. At times the throat feels dry. The patient is a mouth breather, chronic catarrhal for years. Some pain in ears at times. Case is diagnosed tuberculous laryngitis with very extensive infiltration of the arytenoids (There was a note by Dr. Dean "That this looks like a very bad case"). Patient was suspended and thoroughly curretted on April 27. On May 3 the larynx was examined, found badly inflamed, and edematous. Local treatment was continued and on May 10, 1916 the larynx was looking much better and a second suspension was arranged for the near future. The case is responding better than was expected to the treatment and is still under observation.

This case was one of the most extensively involved of those treated with a curative object in view at the Clinic this year, and while not advancing rapidly, is more than holding its own and under favorable conditions should ultimately reach a satisfactory conclusion.

Case XVIII. Mr. H. age 19. Admitted to Iowa Clinic on April 10, 1916. Patient was treated at Mercy Hospital, Iowa City for some time as a private patient by Dr. Dean and comes now to have a currettment of larynx by the suspension method. The epiglottis was removed and the base punched out and cauterized twice before admission. He was treated on April 11 by the
punch and curette operation under suspension and two weeks following the larynx was in a much improved condition. He was put on the usual medicinal treatment and cauterized at intervals of two weeks, the cautery being applied to small ulcerated areas on the base of the epiglottis. When last seen the condition of the larynx was much improved but still in a very unsatisfactory condition. The patient is still under observation and treatment.

The above case was one owing to the extensiveness of the involvement in one of his age does not present a most favorable outlook, but nevertheless he is thorough in his co-operation with the prescribed treatment, and as far as his larynx is concerned, may be considered a fair prospect for recovery.

Case XIX. Miss S. age 20. Admitted to Oakdale Nov. 4, 1915. Condition far advanced, involvement Turban III. Right II. Left II. duration three years. General Condition unfavorable, digestion impaired, presented usual pulmonary symptoms before admission. Admitted to Iowa Clinic on April 26, 1916 complaining of throat trouble. She gave a history of being hoarse for about four months. Her voice had been rough for several months previous to this. Some pain on swallowing at times. Examination showed infiltration of the interarytenoid space and vocal angle and the cords were reddened and thickened posteriorly. A diagnosis of tuberculosis of the larynx was made. She was operated by the suspension method on April 28, and the diseased tissue eradicated as thoroughly as was possible by means of the punch and curette. On May 3, the larynx presented a much improved appearance. There was much less infiltration and the cords were more nearly normal in size. She was on the usual medicinal treatment following the operation. The operation was repeated on June 2, and at the first
of July the larynx presented a nearly normal appearance. She is still under treatment and observation.

This was a case of well marked beginning tuberculosis of the larynx which responded quickly and favorably to the radical treatment.

Case XX. Mrs. P. age 22. Admitted to Oakdale on June 23, 1916. Her condition was classified as Turban I. insipient Right I. Left I. General condition favorable, digestion impaired. She was admitted to Iowa Clinic on Nov. 10, 1915 complaining of throat trouble. She gives a history of hoarseness of about a year's duration which was especially troublesome during the week before admission. Some pain on swallowing and soreness. The soreness is localized in the thyroid region and along the trachea. Examination showed infiltration of the arytenoid cartilages and interarytenoid space tuberculous in nature, and a diagnosis of tuberculous laryngitis was made. She was at once started on the medicinal treatment at the Sanitarium and reported again at the Clinic in one week. Throat showed a marked improvement, and local treatment of lactic acid, steam inhalations, and rest of voice was continued until Feb. 9, 1916 when the larynx presented a normal appearance, and she was instructed to return at intervals for observation.

This was a case in which no other treatment than lactic acid, rest of voice, and steam inhalations was necessary, and which resulted in a rapid clearing up of the trouble.

Case XXI. Mr. B. age 31. Admitted to Oakdale on June 20, 1913. His condition was Turban III. Right III. Left III. duration of three months. General condition favorable, digestion unimpaired. He was admitted to the Iowa Clinic on Aug. 4, 1913,
and was at once started on medicinal treatment with rest of voice, and cautery at about two week intervals. This was continued until June 2, 1915 when he was pronounced cured. He returned to the Clinic on Aug. 4, and Dec. 8, 1915 the last record showing no signs of any recurrence of trouble. Arytenoids and interspace almost normal in size. He has since passed out from under observation.

This case is cited simply as a case which has shown no signs of recurrence after six months, the treatment, however, having been carried out over nearly two years by means of cautery and local treatment. He could probably have been cured in a much shorter time by means of the radical treatment as is well shown by many of the previous cases cited.

In all that were treated by the Clinic either at the University Hospital or at Oakdale 57 cases from July 1, 1915 to July 1, 1916. Of these 21 cases were treated at the former place, and 36 at the latter. Of those cases treated at Oakdale the radical treatment was not used owing to the fact that they were far advanced infirmary patients whose general condition would not warrant such procedure. The treatment in these cases simply consisted of lactic acid, steam inhalations, and rest of voice, and slow progress was the average result, the final result being in many cases interrupted by the death of the patient due to the pulmonary condition or other causes. In addition to these there were four cases treated at the University Hospital who came in in a far advanced stage with laryngismus dolorosa in which an amputation of the epiglottis was done simply as a measure of euthanasia. These cases all ran a rapid and fatal course.
Conclusions.

I. Laryngeal tuberculosis for all clinical purposes may be considered a secondary process.

II. It is an important complication of pulmonary tuberculosis, its importance varying from relatively unimportant to the position of most important.

III. The radical treatment of laryngeal tuberculosis by the suspension method accompanied by local applications and Sanatarium supervision is that to be followed in cases where the prospect of a cure seems feasible. The cautery may be of aid to the radical but should not be relied upon to take its place owing to the greater length of time which its use necessitates.

IV. The percentage of cures secured by the radical treatment is rapidly increasing at Iowa Clinic while the length of time is being materially cut down. The percentage of cures at Iowa compares most favorably with those reported by leading laryngologists and tuberculosis workers in other places.
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