Thesis submitted for the M.D. Glasgow.

# L A R Y N G E A L  T U B E R C U L O S I S

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I wish to take this opportunity of placing on record my thanks to my wife and parents for their constant encouragement.

## C O N T E N T S .

# I N T R O D U C T I O N.

This survey was conducted at Doncaster Sanatorium and Middleton-in-Wharfedale Sanatorium Ilkley, Yorkshire.

In all 440 males suffering from Pulmonary Tuberculosis had their larynges examined of those 100 i.e., 22.7% were found to show some degree of laryngeal infiltration. It is an investigation of those 100 patients with laryngeal tuberculosis which forms the material of this survey.

## HISTORICAL OUTLINE

Tuberculosis is not an exclusive feature of present day civilisation. Signs of Pott's disease have been found, according to Webbs amongst the first ossuary relics of the Neolithic period (ca: 5,000 B.C.). He also instances (p.6) an undoubted case of Pott's disease, which was found in a mummy of the priest of Ammon at Philae belonging to the 21st dynasty, (ca: 1,000 B.C.).

It is Hippocrates (460-377 B.C.) the "Father of Medicine", writes Meachen to whom we owe the term phthisis which he applied to a diminution or shrinking of the body, following incurable ulcers of the lungs accompanied by a small fever.

As in most illnesses, there was a patron saint for throat disease. He was St. Blasius who was martyred in 316 A.D., and is annually remembered in the Roman Church with a "throat blessing" ceremony. Many who suffered from tuberculous laryngitis no doubt sought aid from this saint.

However, it was not until the end of the 18th and the beginning of the 19th centuries

that there was any real scientific contribution to our knowledge of laryngeal tuberculosis. This came mainly from the French school of medicine of this period. Gaspard Laurent Bayle (1774-1816) examined 100 people who died from consumption and found that 17 showed some involvement of the larynx. L.F. Flick mentions how Bayle described the congestion and ulceration frequently found in the tuberculous larynx. Sauvée, (1802) like Bayle, gave a comprehensive description of laryngeal tuberculosis. Neither of them, however, says Wilkinson differentiated between tuberculous and syphilitic laryngitis.

Similarly Trousseau and Belloc H. (1837) according to Wilkinson, in a prize essay, mention that laryngeal tuberculosis usually followed pulmonary phthisis: but, they, like both Bayle and Sauvee, failed to differentiate tuberculous infiltration of the larynx from that of syphilis or malignancy.

One of the outstanding French phthisiologists of this period was Pierre Charles Alexander Louis (1787-1872) who investigated in a systematic manner the signs and symptoms in tuberculosis of the lung, larynx and other structures.

Ernlund states that it was Louis who first advanced the theory of surface infection of the larynx. Laennec (1781-1826) who gave medicine the stethoscope, was first to demonstrate the essential unity of tuberculosis, and Villemin (1827-1892) by animal experiments confirmed the infective nature of phthisis. (quoted by St. Clair Thomson.). But it was Koch who in 1882 finally demonstrated the virus of the disease, and thus opened an entirely new field in the investigation of tuberculosis.

The primitiveness of equipment was for a long time a serious handicap in the elucidation of the clinical signs of laryngeal tuberculosis. It was Manuel Garcia (1855) the London musical and singing teacher, who invented the laryngeal mirror and brought about with this a marked advance in both technique and knowledge.

The treatment of laryngeal tuberculosis has passed through many phases. Hirsch C. (1935) mentions that it was Sachse who in 1821 first advocated surgical intervention in laryngeal tuberculosis. For many years very radical excision of the affected laryngeal parts was practised. Heryng was the first laryngologist to sound a note of caution on the extremely

radical surgery of the period. He wrote "..... in Interesse des Arztes liegt es aber, die chirurgische Methode nur in entsprechenden Fällen anzuwenden" and emphasised that very satisfactory results were to be expected by curettage of the affected parts with a sharp spoon.

G. Norman Meachen states that it was Schmidt who in 1876 first advocated the local application of antiseptics to the larynx affected with tuberculosis.

Gradually the treatment of tuberculous laryngeal lesions has become more conservative. The day of radical excision, punch forceps and curettes has passed and now only the electrocautery is employed by the laryngologist. Vocal rest therapy was popularised, although not discovered by St. Clair Thomson, and has now become the sheet-anchor of therapy in laryngeal tuberculosis.

Finally, Julius Dworetzky's interesting statistical investigations on the effect of collapse therapy on laryngeal tuberculosis are beginning to be widely accepted, and may well usher in a new phase in laryngeal treatment.

ANATOMY OF THE LARYNX.

The larynx in the adult male is situated opposite the 3rd, 4th, 5th and 6th cervical spines. In the male, though not in the female, an increase in the size of the larynx occurs after puberty.

Nine cartilages constitute the "skeleton" of the larynx and those are connected by ligaments, membranes and muscles. They are the thyreoid, cricoid, epiglottis, two arytenoius, two corniculate and two cuneiform cartilages.

THYREOID.

This is the largest of the cartilages of the larynx. It has two laminae, which fuse anteriorly to form the pomum Adami. At its upper margin is a "V" shaped notch the superior thyreoid notch.

On the outer surface of the lamina there is an oblique line, which forms the attachment of the sternothyreoid, thyreohyoid and constrictor pharyngis inferior muscles.

On the inner surface of the lamina the thyreo-epiglottic, ventricular and vocal ligaments, and thyreo-arytenoid, thyreo-epiglottic and vocal muscles are attached.

The thyreo-hyoid membrane and crico-thyreoid ligaments are attached to the upper and lower borders of the thyreoid laminae.

CRICOID CARTILAGE.

The cricoid cartilage is smaller though stronger and thicker than the thyreoid, and forms the lower and posterior part of the larynx. It consists of a broad posterior quadrate lamina and a narrow anterior arch.

Two fasciculi of the longitudinal fibres of the oesophagus and the cricoarytenoideus posterior are attached to the cricoid lamina, while the cricothyreoid muscle is attached to the front of the cricoid arch.

The upper border of the central and lateral parts of the cricoid arch give attachment to the crico-thyreoid ligament, and the conus elasticus and crico-arytenoid laterales respectively.

ARYTENOID.

There are two arytenoid cartilages situated at the right and left upper borders of the cricoid lamina. Those are pyramidal in form, and their posterior triangular surfaces are covered by the arytenoideus transversus muscles.

The antero-lateral surface of the arytenoid has two depressions, an upper and a lower. The ventricular ligament is attached to the former, and the vocalis and cricoarytenoideus lateralis muscles are inserted into the latter.

At the base of the arytenoid a muscular process projects back to give insertion to the cricoarytenoideus posterior and cricoarytenoideus lateralis.

The apex of the arytenoid articulates with the corniculate cartilage.

CORNICULATE CARTILAGES.

These consist of two small nodules of yellow elastic cartilage, which are situated in the aryepiglottic folds.

EPIGLOTTIS.

This is a thin lamella of yellow fibro-cartilage which stretches upwards behind the tongue and the body of the hyoid bone. The free extremity is directed upwards, and the attached part is connected by the thyreo-epiglottic ligament to the angle formed by the two laminae of the thyreoid cartilage. From the sides of the epiglottis, aryepiglottic folds of mucous membrane are attached to the arytenoid cartilages.

The anterior face of the epiglottis is free, and its surface covering of mucous membrane is reflected on to the pharyngeal part of the tongue to form the central median and the two lateral glosso-epiglottic folds.

On either side of the median glosso-epiglottic folds there are depressions called valleculae.

The lower part of the anterior surface is connected by the hyoepiglottic ligament to the upper border of the hyoid bone.

LIGAMENTS OF THE LARYNX.

Thyreohyoid Ligament. The thyreoid cartilage is connected to the hyoid bone by the thyreohyoid membrane. This consists of a broad layer of fibro-elastic tissue, which is attached above to the upper margin of the posterior surface of the body, and the greater cornu of the hyoid bone and below to the upper border of the thyreoid cartilage, On each side, where the membrane is thinner, it is pierced by the superior laryngeal nerve.

Crico-Tracheal Ligament. This ligament stretches from the first tracheal ring to the lower border of the cricoid cartilage.

Crico-Thyreoid Membrane or Conus Elasticus. This consists largely of yellow elastic tissue and is strong anteriorly forming the median crico-thyreoid ligament, which connects the anterior portions of the thyreoid and cricoid cartilages. The lateral portions are thinner and extend from the superior border of the cricoid cartilage to the deep surface of the thyreoid angle and to the vocal process of the arytenoid cartilage.

THE LARYNGEAL CAVITY.

The entry to the larynx commences at the upper edge of the epiglottis, and the aryepi-glottic folds. The lower margin or exit of the larynx extends from the level of the vocal folds to the lower border of the cricoid cartilage. The laryngeal cavity contains the following structures.

The Ventricular Folds or False Vocal Cords, consist of two thick folds of mucous membrane.

The Vocal Folds or True Vocal Cords are two folds of mucous membrane, which stretch from the middle of the angle of the thyreoid cartilage to the vocal processes of the arytenoid cartilages. They are covered by stratified squamous apithelium and their white pearly colour is due to the absence of the submucous layer with its contained blood vessels.

The Ventricle of the Larynx, is a small recess between the ventricular and vocal folds, which is lined by mucous membrane and contains the opening of the laryngeal saccule.

The Laryngeal Saccule is a pouch which commences at the anterior portion of the ventricle and extends upwards, sometimes as far as the upper margin of the thyreoid cartilage. It is lined by mucous membrane, which contains the openings of a large number of mucous glands whose secretion lubricates the surface of the vocal folds.

The fissure between the vocal folds anteriorly and the vocal processes of the arytenoid cartilages posteriorly is termed the rima glottidis. The size of the rima glottidis varies with respiration, phonation and the sex of the subject.

There are a large number of intrinsic and extrinsic laryngeal muscles in the larynx. A description of them is not, however, essential to this study of laryngeal tuberculosis.

GLANDS.

The laryngeal mucous membrane is richly supplied with mucous glands. They are particularly numerous on the epiglottis, in the margins of the aryepiglottic folds and in the laryngeal saccules.

LYMPHATIC VESSELS.

The lymphatic vessels above the vocal folds accompany the surperior laryngeal artery, then pierce the hyo-thyreoid membrane, and later enter the deep cervical lymphatic glands near the bifurcation of the common carotid artery.

Those below the vocal folds pierce the crico-thyreoid ligament and open into a lymphatic gland lying anterior to the trachea or in front of the ligament and terminate in the deep cervical lymphatic glands close to the inferior thyreoid artery.

ARTERIES.

The arterial supply of the larynx is from laryngeal branches of the superior and inferior thyreoid arteries.

VEINS.

The venous drainage is into the superior and inferior thyreoid veins. The former enters the internal jugular, and the latter the innominate vein.

NERVES.

The internal laryngeal branch of the superior laryngeal nerve is almost entirely sensory and pierces the hyothyreoid membrane with the superior laryngeal artery. It supplies the epiglottis the aryepiglottic folds and the interior of the larynx down to the vocal cords.

The external laryngeal branch of the superior laryngeal nerve pierces and supplies the crico-thyreoid muscle.

The inferior laryngeal nerve is a continuation of the recurrent nerve. It supplies all the intrinsic muscles of the larynx except the crico-thyreoid, and distributes sensory branches to the interior of the larynx below the vocal cords.

PHYSIOLOGY OF THE LARYNX.

The larynx has a number of physiological functions. It plays an important role in phonation, expectoration, coughing, deglutition and the maintenance of intrathoracic pressure.

PHONATION AND RESPIRATION.

In the production of speech the lungs act as a "bellows", air being forced up through the bronchi, trachea and larynx. The blast of air is then projected through the nasal and air passages which act as resonators.

According to Guthrie, the vocal note is not produced by the laryngeal muscles. During respiration the air is expelled through the trachea by the lungs and the function of the laryngeal muscles is to hold the cords in a certain position and at a certain tension. In phonation the vocal cords are hardened by muscular action, and by increasing the pressure of air from the lungs, the glottis is opened and some air escapes. Due to the elasticity of its margin the glottis again closes and by the rapid succession of those movements of opening and closing a note is produced. The pitch of this note is determined by the number of glottic movements per second. Negus is of opinion

that the cord vibration occurs in a vertical direction, whereas Pressman believes this vibration to occur in a horizontal plane.

Thus the vocal sound appears to depend on:-

(a) The mobility of the vocal cords.

(b) The tension of the vocal cords.

(c) The approximation of the vocal cords, as sound, according to Myerson, is not produced if they are more than 1.5-2 m.m. apart.

(d) The passage of a blast of air under pressure through a chink in the glottis.

Any disturbance in the physiological mechanism can give rise to abnormal phonation. Thus alterations in the larynx due to swelling or the presence of mucous secretions, or failure of the arytenoids to approximate may result in alterations in the voice.

DEGLUTITORY FUNCTION.

C.L. Jackson and C. Jackson state that the larynx "participates in two distinct ways in the swallowing function".

(1) It is carried upwards when the inferior constrictor muscles contract in order to grasp the bolus and force it downwards.

(2) It must shut the airway tightly so that neither food nor liquid can enter the air passages.

The presence of ulcers on the inner aspect of the larynx may give rise to pain on swallowing due to the sphincteric contraction of the larynx.

PROTECTIVE FUNCTION.

Another important function of the larynx is the protective cough reflex which prevents the entry of any foreign material into the air passages. This takes place by the following mechanism.

The larynx is first tightly closed, then by thoracic compression the positive pressure in the air-passages is increased. When the larynx is suddenly opened the blast of compressed air is released and the foreign body or food material is carried away with it.

## PATHOLOGY.

### "Primary Laryngeal Tuberculosis".

The question of whether laryngeal tuberculosis was a primary condition or secondary to a tuberculous involvement elsewhere has been a subject of some controversy in the realms of phthisiology.

As early as 1887 Heryng stated that primary laryngeal tuberculosis, which was previously looked on as a rarity or as non-existent, was a fairly frequent clinical finding. Richard Lake (1901) had much the same attitude to this problem. He states ".....it has been demonstrated beyond cavil, that, a primary infection of the laryngeal structures may occur and in all probability does occur far more frequently than by the nature of the proof required we are able to show". Such was the viewpoint expressed before the era of radiography, and no doubt many cases diagnosed as primary laryngeal tuberculosis, were, in actual fact, secondary to pulmonary tuberculosis, which was clinically undetectable.

Wood and Griebel express the opinion of most laryngologists in accepting laryngeal tuberculosis as a secondary tuberculous development, although admitting the posibility of it being occasionally a primary lesion.

Cooper and Benson are more emphatic, and state that laryngeal tuberculosis "must always be considered a complication of co-existing tuberculosis elsewhere in the body". Brieger and Pagel, Charlier and Wood all record cases noted by themselves or others where the diagnosis of primary laryngeal tuberculosis could have justifiably been maintained. They all stress, however, the importance of an ample investigation, including both biopsy and post-mortem examination, before making such a diagnosis.

An interesting point is suggested by Howie that the local or general hyperaemia to be found in tuberculous laryngitis is not so much an invasion by the bacillus as a local allergic response to allergens from the lung tissue similar to that postulated in a pleural effusion or erythema nodosum.

Classification of Laryngeal Tuberculosis.

For the purpose of simplification the following arbitrary classification of laryngeal tuberculosis has been adopted.

Types:- I Malignant.

II Acute.

III Subacute.

IV Chronic.

It must be emphasised that those types are not rigid entities. With the exception of the malignant form, they may readily pass from one stage to another.

Malignant. In the malignant form the epiglottis, arytenoids and aryteno-epiglottic and ventricular folds are swollen and fine yellow tubercles may be observed on the surface of the arytenoid cartilages. Rapid ulceration and necrosis almost always occur in this type of lesion.

Acute. In the acute form all structures are swollen and involved as in the malignant type. Here again ulceration may occur, but there is also some tendency to healing by fibrosis.

Subacute. This may commence independently as a subacute form, or may have developed from the acute or chronic forms. Part of the larynx may show pseudo-oedematous swelling, but in this subacute type there are always good powers of resistence and satisfactory fibrosis frequently occurs. Occasionally small papillary excrescences are to be observed.

CHRONIC. In this form there is little or no swelling of the laryngeal structures. Firm and well defined infiltrations are to be found, and they always show a pronounced tendency to healing.

HISTOPATHOLOGY.

The earliest manifestation of laryngeal tuberculosis is infiltration of the submucous tissues by "tubercles", which may or may not be accompanied by oedema. The presence or absence of oedema is dependent on the general and local resistance of the patient. In patients with a high resistance no oedema is encountered, whereas cases showing a low degree of resistance are invariably accompanied by some oedema.

During the stage of infiltration the following histopathological changes are found.

Small papillary indentations developing in the region of the basement membrane cause the base of the epithelial layer to show undulations. The blood vessels are surrounded by groups of cells mainly lymphocytes, and some fibrous tissue is to be found thickening their adventitial coats.

When infiltration of the submucous tissues is accompanied by oedema, a rather different histological appearance is noted. The oedematous infiltration has a transparent or finely granular

appearance which is to be seen in all the loose cellular laryngeal tissues. Both fibres and cells are poorly stained and swollen, and there are few signs to suggest tuberculosis.

Laryngeal infiltration of the submucosa may advance to ulceration or perichondritis. In the former (ulceration) the typical tuberculous ulcer is to be observed. This is formed by the subepithelial tubercles, which become converted into a mass of granulation tissue. It is, according to Ormerod, the superficial spread of the granulation tissue and not the necrosis of the epithelium overlying the nodule which gives rise to ulceration. Once the surface is reached the loss of tissue in the centre of the exposed area of granulation tissue becomes the typical tuberculous ulcer. It reveals a granular floor which sheds small masses of cells at intervals, and is surrounded by a zone of hyperaemia with an infiltration of round cells. At first, when small, the ulcer is circular, later it becomes irregular and several ulcers may finally coallesce to form a single large ulcer.

PERICHONDRITIS.

Perichondritis is an extension downwards of the infiltration into the deeper tissues. The epiglottis and arytenoid cartilages are the structures usually implicated. The perichondrium is found to be swollen and studded with small tubercles. There is invariably some accompanying oedema, particularly when the perichondritis is unaccompanied by ulceration of the surface epithelium.

Ormerod is of opinion that the swelling and oedema of the membrane results in the perichondrial layer being lifted. This deprives the underlying cartilage of the necessary nourishment and causes necrosis with sequestrum formation to occur in its interior. The sequestrum may then be extruded in a single piece or in fragments.

TUBERCULOMATA.

In some cases hypertrophy of the superficial mucous membranes occurs, and this may advance to form a new growth or tuberculoma. This new growth is to be found in both anterior and posterior parts of the larynx, the interarytenoid region being a frequent site of involvement.

Myerson is of opinion that every tuberculoma is first a granulotuberculoma and later may develop into a fibrotuberculoma. As the name implies, the histological appearance of the latter shows an abundance of fibrous rather than cellular tissue.

Both the fibrotuberculoma and granulo-tuberculoma are pale or pink in colour, and are usually pedunculated, although those occuring in the interarytenoid region may be moulded by the adducting vocal cords.

## PATHWAY OF SPREAD OF INFECTION TO LARYNX.

There are a number of theories on the manner and path of spread of the bacillus tuberculosis from the lung to the larynx. Some of these conflicting theories on the mode of spread have as their protagonists some of the most eminent phthisiologists and laryngologists, and it is thus extremely difficult to arrive at any final attitude on this question.

Four theories have been postulated as to the path of spread.

(1) Direct Spread. (2) Lymphatic Spread.
(3) Blood Spread. (4) Allergic Response.

### DIRECT SPREAD.

It must be freely admitted that this is the most frequent route of laryngeal involvement. The path of spread would be a direct or bronchogenic route from the cavity via the bronchiole and bronchus up to the larynx. This view is supported by the frequency with which patients suffering from laryngeal tuberculosis show tubercle bacilli in their sputum.

Dworetzky found in 1914, that 91% of 500 of his laryngeal cases were sputum positive. A later survey by the same investigator in 1934,

on a further 500 adult cases of laryngeal tuberculosis revealed an even closer correlation. In this case 98% were sputum positive. Similarly Schuster found the sputum to be positive in 82% of a large series of laryngeal cases.

In 100 laryngeal cases personally investigated 84 were found to have positive sputa. When the 100 cases were arranged according to the type of pulmonary lesion, viz., fibrotic and fibro-caseous or caseo-fibrotic, they revealed the following distribution.

TABLE (a).

| No. of investigated laryngeal cases | No. showing Fibrotic Pulmonary disease | No. showing Fibro-caseous or caseo-fibrotic disease. |
|---|---|---|
| 100 | 24 | 76 |

Furthermore, among the 24 cases showing the fibrotic type of pulmonary lesion 15 or 62.5%, and 69 or 90.8% of the 76 caseo-fibrotic or fibro-caseous type of pulmonary lesions had positive sputa. (See Table (b)).

TABLE (b).

| Type of Pulmon. Lesion in 100 Laryngeal cases examined. | No. of Pulmon cases. | No. of cases showing positive sputa. | %age of cases showing positive sputa. |
|---|---|---|---|
| Fibrotic | 24 | 15 | 62.5 |
| Fibro-caseous or Caseo-fibrotic | 76 | 69 | 90.8 |

The terms "fibrotic" and "fibro-caseous" or "caseo-fibrotic" were applied as follows.

"Fibrotic"...where there are no radiological signs of cavitation.

"Fibro-caseous" or "caseo-fibrotic"...where there are radiological signs of cavitation.

The above two tables indicate the close correspondence to be observed between laryngeal tuberculosis and fibro-caseous pulmonary disease with a positive sputum. A much closer relationship is found to exist between laryngeal phthisis and pulmonary phthisis with cavitation, than in pulmonary lesions of the fibrotic or productive type. It is possibly for this reason that tuberculous laryngitis is a less frequent occurence over forty years of age as both the

lesion and the pulmonary tissue have become more fibrotic.

It should be noted that the existence of a fibrotic pulmonary lesion as revealed by roentgenogram merely means the absence of visible radiological cavitation, though minute cavities might well be found on autopsy. Hence, laryngeal tuberculosis in a "radiological" productive lesion does not negate the possibility of direct spread.

The most frequent site of infiltration in laryngeal tuberculosis will be considered in greater detail later. Generally, this is found to be more prevalent in the posterior rather than in the anterior part of the larynx. This is not surprising, as sputum containing tubercle bacilli would tend to lodge in this narrow confined area. The possibilities of infiltration would moreover appear to be especially great at night, when the infected sputum rests in this region for long periods without being expectorated.

The recent histopathological findings by Spencer and Summerill following post-mortem investigation of a number of cases of pulmonary tuberculosis without macroscopic laryngeal involvement suggest that "the most

frequent site was in pockets about the cords in which it is readily conceivable organisms can be lodged."

The criticism of this theory of direct spread is that a large number of patients with heavily laden sputa, never develop laryngeal tuberculosis, though their larynges may be bathed for years in a heavily infected sputum. While this is true, it must be remembered that many individuals exposed to massive doses of tuberculosis, (such as sanatorium doctors and nurses,) never contract this disease. Thus there are other factors such as local immunity to the bacillus which cannot be ignored in the consideration of this problem.

Another ground for criticism of the 'direct" theory is the finding of laryngeal tuberculosis in patients showing a negative sputum. Such a view, would appear to conflict with the thesis of spread due to an infected sputum. However, Fenton states..."mere absence of bacilli in sputum is of little significance"..."sputum with bacilli may have been responsible at an earlier date for infection". Wood expresses a similar belief.

Once the surface of the laryngeal mucosa is reached by the bacillus, it would probably penetrate into the subepithelial tissues. Dworetzky states..."we know that the tubercle bacillus can penetrate the mucous membrane of the larynx even when the latter is in a healthy condition."

Furthermore, in pulmonary tuberculosis the external laryngeal covering is frequently traumatised by coughing and inflammation. Hence the passage of the tubercle bacillus to the subepithelial structures would prove a simple matter.

Four possible paths by which the tubercle bacillus can gain access to the subepithelial tissue from the surface are described by Wood.

1. Through unbroken epithelium.
2. Through ducts of racemose glands.
3. Through traumatic abrasions.
4. Through pathological epithelium.

LYMPHATIC SPREAD.

The theory of the lymphatic route from the lung to the larynx is grounded largely on the fact that this represents the typical mode of spread of the tubercle bacillus, rather than on positive anatomical evidence. Again, a tuberculous focus in the larynx is usually found to be situated in the subepithelial structures. This being the

region of distribution of the fine lymphatic channels, the conclusion is drawn that this is the path of spread. Ruedi of Davos suggests that it is for this reason and also because of the slowing up of the lymph stream in this locality that the tubercle bacillus localises itself with preference on the interarytenoid surface. Chevalier Jackson also supports this hypothesis. He writes..."there is also much to support the opinion that the invasion of the larynx is from the lungs upwards through the lymph channels". On this assumption (i.e. lymphatic channel) it would appear that a definite relationship could be established between a unilateral pulmonary involvement and an early ipso-lateral infiltration of the larynx. Such a finding has never been satisfactorily demonstrated.

Finally, the question of whether there is a lymphatic supply to the vocal cords - a frequent site of infiltration - has never been adequately demonstrated. Even Chevalier Jackson an ardent supporter of the lymphatic theory, admits that..."in the elastic tissues of the cords, lymphatics are practically absent and few are to be found in the supporting tissues of the cords".

BLOOD SPREAD.

The spread of the tubercle bacilli by the blood stream from the lung to the larynx is generally acceded. This form of spread appears according to Dworetzky, to be typical of the haematogenous type of pulmonary infiltration. This may be seen in all grades from very severe and usually fatal generalised miliary tubercle to the benign form which is observed in limited areas which eventually clears without leaving a trace. According to Miller (quoted by Dworetzky) 20 to 30% of all cases of laryngeal tuberculosis are due to blood spread. There is certainly no doubt that a high percentage of very ill cases develop laryngeal tuberculosis as a terminal manifestation. A sudden and generalised oedema of the arytenoids, aryepiglottic folds and ventricular folds, being the commonest manifestation. In this connection, it is interesting to note that Eli H. Rubin found that "two out of every three cases dying of phthisis had tuberculous intestinal lesions, and of those dying of laryngeal disease, 90% had intestinal lesions. For patients under 30 years of age, this figure became 95%." A similar observation was made by Heaf. In 150 post-mortem cases of pulmonary

tuberculosis, he found that 68% showed involvement of the larynx and 44% revealed intestinal ulceration. Such evidence suggests the larynx and intestine as frequent sites of involvement in terminal pulmonary tuberculosis, due to a blood spread.

ALLERGY.

An endeavour has been made by Howie, Myerson and others to link up the general conception of allergy in tuberculosis with the clinical findings of laryngeal tuberculosis. The former suggests that local or generalised hyperaemia does not represent an invasion by the tubercle bacillus, but a "local allergic response to allergens from lung tissue similar to that found in pleural effusion or erythema nodosum."

It is difficult, however, to accept the thesis that a generalised congestion of the larynx in a case of pulmonary tuberculosis is a local allergic response to allergens and not a simple laryngeal catarrh.

GENERAL CONCLUSIONS ON THEORIES OF SPREAD.

It appears probable in the light of the existing evidence that there is a direct spread of infection from the lung to the larynx in the vast bulk of cases. However, in miliary forms

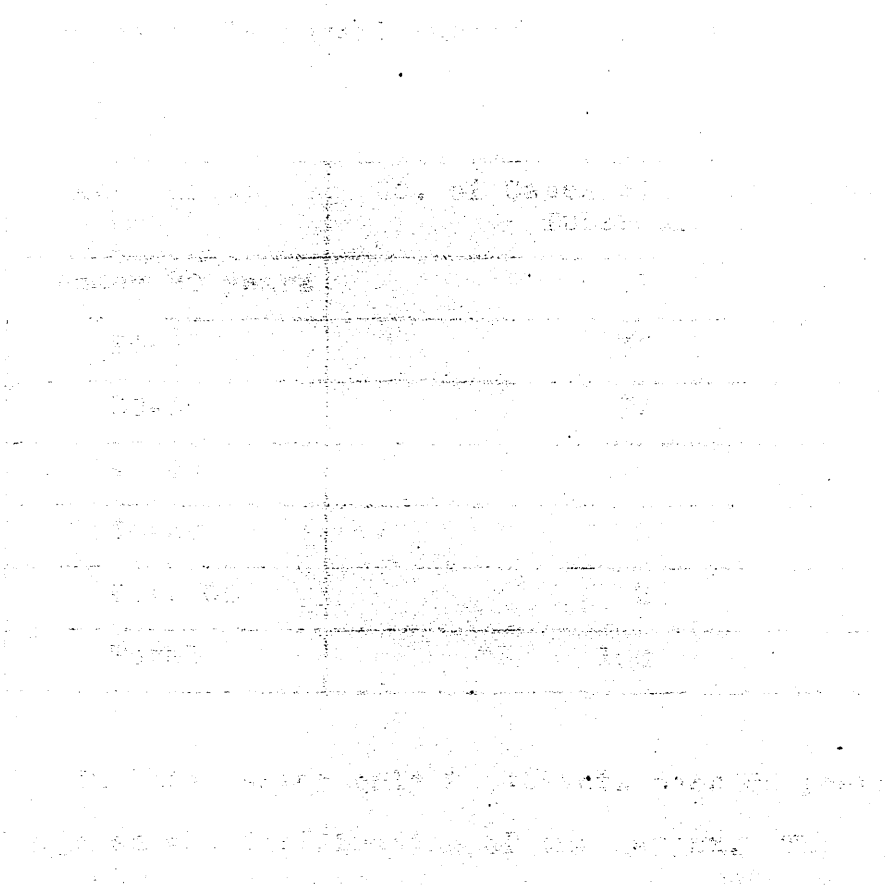
of pulmonary tuberculosis and in the terminal stages of this condition - the path of infection from lung to larynx is quite possibly via the blood stream.

PREDISPOSING FACTORS.

There are a number of factors which have been claimed as being predisposing factors in the causation of laryngeal tuberculosis. The tonsils have been regarded by some as a possible focus. Rubin and Galburst state in this connection... "infection from tonsils and adenoids must be considered". On the basis of a streptococcal infection of the larynx following infection of tonsils, they suggest a similar parallelism in tuberculous laryngitis. Chevalier Jackson is perhaps more precise in this regard. He writes ..."there is much in support of the opinion that the route downwards through the lymphatics is from the tonsils, where the tubercle bacilli has been harboured with or without having produced a local lesion: most often without."

In a series of 100 cases of laryngeal tuberculosis reviewed in the course of this investigation 21% were found to have "infective" (congested or enlarged, septic or cryptic) tonsils.

Of the remaining 340 patients with pulmonary tuberculosis, but revealing no sign of laryngeal infiltration, 62 i.e.18.2% showed "infective" tonsils. Thus the tonsils cannot be regarded as a factor of any importance in the causation of this complication.



AGE.

The age of the patient in relation to laryngeal tuberculosis has been investigated by George Wilson (1941( Taylor and Nathanson (1934), Richard Lake (1901) and many others. There is general agreement that this condition occurs more frequently in the 20-29, and 30-39 age groups than in any other period of life.

A similar age distribution was observed in 100 cases of laryngeal tuberculosis of this survey.

| Age Group | No. of Cases with Laryngeal Tuberculosis. |
|---|---|
| Under 20 years | 11 |
| 20-29 | 35 |
| 30-39 | 27 |
| 40-49 | 19 |
| 50-59 | 6 |
| Over 60 | 2 |
| Total | 100 |

In this survey only 2 patients over 60 years of age showed infiltration of the larynx. The above finding indicates how infrequently the larynx is affected in the older age group.

OCCUPATION.

In the opinion of Lake (1901) and Ernlund (1929) it is doubtful if occupation has any effect on the incidence of laryngeal tuberculosis. Wilson, however, finds that a higher frequency exists amongst the labouring classes. Mervin Myerson states the position rather differently; he suggests that the determining feature is not the type of occupation, but the social and economic standards of the patient.

The relationship of occupation in the 100 cases under review to this complication is illustrated by the following table:-

| OCCUPATION. | NO. OF CASES. |
|---|---|
| Miners | 22 |
| Engineers and Munition Workers. | 12 |
| Labourers. | 9 |
| Agricultural Workers. | 8 |
| Clerks. | 7 |
| Transport Workers. | 6 |
| Railway Workers | 5 |
| Textile Workers | 4 |
| Salesmen and Travellers | 3 |
| Builders. | 3 |
| Printers. | 3 |
| Painters. | 3 |
| Carpenters | 2 |
| Plumbers. | 2 |
| Hairdresser, Teachers, Student, No occupation, etc. | 11 |
| | 100 |

It might appear from this analysis that the percentage of miners, munition workers and labourers, who contract laryngeal tuberculosis, is extremely high. However, it must be emphasised that this distribution is largely due to the 'social class' of patient admitted for treatment, and to the geographical distribution of the sanatoria, i.e. mining and industrial areas where this investigation was conducted.

SIGNS ON EXAMINATION.

The findings on examination in laryngeal tuberculosis are extremely varied. All stages of activity in this disease are encountered and those may be accompanied by some degree of healing. Furthermore, the infiltration may be localised or extremely widely disseminated throughout the laryngeal structures. There is some difference of opinion as to which anatomical portion of the larynx is the most frequent site of tuberculosis, but there is complete unanimity that the posterior wall and its adjoining structures show the highest incidence of infiltration.

The following broad and very loose classification is helpful in consideration of tuberculosis of the larynx.

Infiltration
which may ↓ advance to
Ulcer ↓ -ation
which may ↓ result in
Perichondritis and Necrosis
as terminal manifestations.

As already indicated infiltration, ulceration or perichondritis and necrosis may all be present simultaneously. They may all with the exception of the latter be accompanied by a variable amount of healing with the formation of fibrous tissue.

St. Clair Thomson found that in 142 cases where disease was limited to one area of the larynx, solitary lesions were found in the following order of frequency.

| Site of Lesion. | Frequency of Occurence |
|---|---|
| Interarytenoid Region | 59 |
| Vocal Processes | 39 |
| Vocal Cords | 24 |
| Arytenoids | 8 |
| Epiglottis | 6 |
| Aryepiglottic Folds | 3 |
| Ventricular Bands | 3 |
| | 142 |

The interarytenoid region showed involvement by solitary lesions in approximately one-third of all investigated cases.

Analysis of 100 cases under review in this investigation showed that there were 34 solitary lesions. When, however, all multiple and single lesions were arranged in order of frequency according to their distribution in the larynx, the following incidence was noted.

DISTRIBUTION OF BOTH MULTIPLE AND SINGLE LESIONS ARRANGED IN ORDER OF FREQUENCY.

| Site of Lesion. | Frequency of Occurence |
|---|---|
| Vocal Cords and Processes | 73 |
| Interarytenoid Region | 65 |
| Arytenoids | 52 |
| Ventricular Bands | 33 |
| Epiglottis | 23 |
| | 246 |

It would seem that vocal cords and processes and interarytenoid region were the most frequent sites of involvement. The epiglottis was only affected on 23 occasions and in most of these was accompanied by extensive infiltration of all structures of the larynx.

When the 34 cases showing laryngeal lesions limited to one area were arranged according to their distribution, they were found to occur in the following frequency.

| Site of Lesion. | Frequency of Occurence |
|---|---|
| Vocal Cords and Processes | 16 |
| Interarytenoid Region | 12 |
| "Arytenoids" | 4 |
| Ventricular Bands | 2 |
| Total | 34 |

It will be noted that in no case was a solitary lesion found on the anterior laryngeal wall. The most frequent sites of infiltration were as in the 'multiple' lesions in the vocal cords and processes and the interarytenoid region. In only two cases was the initial site of involvement found to be in the ventricular bands.

GENERAL.

In a number of cases of pulmonary tuberculosis where the larynx was examined, a generalised anaemia or congestion was observed. Such findings were occasionally noted not merely in the larynx but also in the pharynx and palate. Many authors have commented on the significance of those signs. Both James Finlayson and Robert Fleming regarded this as an early form of laryngeal tuberculosis.

To-day, however, most authors regard both pallor and hyperaemia of the mucous membranes as only a manifestation of the patients general condition and not as a characteristic feature of laryngeal tuberculosis except when such involvement is localised and asymmetrical in distribution. It is generally accepted by most authors that a case of pulmonary phthisis showing pallor or hyperaemia of the larynx should be kept under careful observation.

Walter Howard discusses this question very fully and it would be well to quote his views on this matter.

....."Do such departures from this normal" (anaemia, generalised erythema or fullness in the interarytenoid region) "occurring in a phthisical subject possess more than usual significance, and is there such a thing as a pre-tuberculous stage of the disease? I believe that many people consider that there is such a stage. Personally, I am disinclined to admit this designation and I would prefer to regard the local anaemia as a part of a more general one, and the catarrhal laryngitis as a not unusual accompaniment of the chronic cough, while

the passage of sputum over the interarytenoid fold is surely sufficient to cause a little local hypertrophy without this being of necessity due to a definite tuberculous infection".

Tuberculous infiltration of the structures which compose the larynx will now be considered in some detail.

INTERARYTENOID REGION.

As already indicated the interarytenoid area was a single site of infiltration in 12 out of 34 solitary lesions. This region was involved on no fewer than 65 occasions out of a total of 246 multiple lesions.

This site should always be carefully scrutinised in a potential case of laryngeal tuberculosis There may be a small asymmetrically placed patch of congestion which may develop into a small flat or slightly raised convex plaque. In tuberculosis this plaque is not exactly central in situation. After a time the infiltration becomes shaped by phonation to form an inverted V shaped structure. At the centre of the peak, ulceration usually occurs in the advancing type of lesion. The size of the deposit or of the ulcer may vary widely from a pin-point to extensive damage of the entire interarytenoid zone.

VOCAL CORDS AND PROCESSES.

In this series of 100 cases the vocal cords and processes were the single site of infiltration in 16 out of 34 solitary lesions, Amongst 246 multiple lesions this area was involved no fewer than 73 times.

The posterior third and the central areas of the vocal cord are the usual seat of tuberculous disease. This incidentally, seems to add additional weight to the evidence in favour of sputogenic infection of the larynx.

Injection of the upper surface or loss of lustre of the vocal cord must always be viewed suspiciously as a prodromal sign of infiltration, especially when this is found to be asymmetrical in distribution. The congestion of vessels on the upper surface of the cord are usually found to run in the long axis of the vocal cord. A small tubercle may gradually reveal itself in this area and its presence is accentuated by a small ring of ischaemia at its periphery. By this time the cord may cease to have a flat upper surface with a sharp well defined medial edge and is now observed to be rounded with an irregular margin.

On the affected surface of the cord a small boat-shaped, shallow, greyish-yellow ulcer may soon be found. This may be accompanied by a variable degree of fibrosis or oedema depending on the healing power or activity of the lesion.

Both Blegvad and R. Scott Stevenson stress the importance of swelling on the lower surface of the vocal cords, as one of the earliest signs of laryngeal tuberculosis.

Infiltration in and around the vocal areas may give rise to impairment of movement in those structures. Chevalier Jackson indicates that such defect in cord mobility may be due to a number of causes.

(a) Involvement of the crico-arytenoid cartilage.

(b) Weakness of the musculature of the larynx.

(c) Infiltration of the 'vocal' muscles by a tuberculous focus.

(d) Damage to the controlling nerve by tuberculous neuritis.

(e) Tuberculous infiltration of the posterior commissure which may render it impossible for the muscles to pull the cords into apposition.

(f) A tuberculous compressive lesion in the course of the recurrent nerve.

(g) A central tuberculous lesion.

As in other areas spread of infection may take place from the vocal cords to the surrounding areas, such as the arytenoid processes, the ventricular folds and the inter-arytenoid space.

Ventricular Folds.

As the above analysis has indicated the ventricular fold is not frequently a source of 'primary' laryngeal involvement. Usually disease has spread from the adjacent vocal cords or aryteno-epiglottic folds. In only two cases out of a total of 34 'single' laryngeal lesions were the ventricular folds affected. However, on 33 occasions out of a total of 246 'multiple' lesions the ventricular folds were the site of tuberculous disease.

The earliest stage of infiltration is often seen as a small area of congestion at the centre of the ventricular fold which may later show some swelling and infiltration. The central swollen portion of the ventricular fold gradually tapers off to the periphery of the fold.

Often the first obvious sign of infiltration of the ventricular folds is a variation in the width of the vocal cords. This is produced by the

overlapping of the cords by the ventricular bands. This may become so marked that the cords may become entirely obscured from view on indirect laryngoscopy. Swelling and oedema of the folds occur frequently because of their loose ciliated epithelial covering.

Ulceration may be found on the ventricular band. Generally, this is dirty grey in colour, is situated superficially and has an ill-defined edge which may spread to the adjacent structures.

The Ventricle of Morgagni and its offshoot the sacculus laryngis are pockets of mucous membrane which extend outwards between the cord and ventricular band. Occasionally prolapse of the ventricle has been recorded as the only laryngeal affection. This, according to Dr. Jorgen Moller, has the appearance of a long red swelling along the lateral edge of the vocal cord or cords or as a little prominence above the foremost or hindmost parts of the vocal cords.

Arytenoid Cartilages.

When multiple lesions of the larynx were considered, the arytenoid cartilage was found by Mervin Myerson to be the most frequent site of infiltration. In the series of investigated cases, the arytenoid cartilages showed infil-

tration in 4 out of 34 cases showing 'single' lesions. Furthermore, 'arytenoid' involvement was noted 52 times out of a total of 246 multiple lesions.

The arytenoid cartilage has a cartilaginous skeleton and also a very loose submucous layer. Due to the latter covering even a slight degree of infiltration will often give rise to marked swelling of this structure, which tends later to spread to the aryepiglottic fold. Initially only one arytenoid may be involved but this soon becomes bilateral. Even when both arytenoid cartilages are implicated the lesions are never symmetrical.

The arytenoid may swell to four or five times its normal size giving rise to pseudo-oedematous appearance. Characteristically two large pear-shaped pink or red swellings may be seen in the posterior segment of the larynx which if large may completely obliterate the inter-arytenoid space.

Occasionally, tiny nodules or fine yellow specks may be observed on the arytenoids.

The ulcers are usually superficial and are found on the superior and posterior surface of the arytenoid process. They are greyish yellow

in colour with an ill-defined edge which merges into the surrounding tissue. A single large ulcer may spread on to the anterior internal aspect of the aryepiglottic fold.

The crico-arytenoid joint may become ankylosed and as already mentioned partial fixation of the corresponding cord may result.

Epiglottis.

The epiglottis is not often the site of a 'primary' lesion. This is seen in the statistical analysis of the 100 cases, where the epiglottis was never observed as a 'single' lesion. In 'multiple' lesions the epiglottis was implicated 23 times out of a total of 246 infiltrations.

Tuberculous involvement is frequently found along the upper surface of the epiglottis. The laryngeal surface is less frequently affected. This is often accompanied by oedema of the anterior surface when the glosso-epiglottic fossae become difficult to investigate. If involvement is of the acute variety the glosso-epiglottic folds become large and boggy.

The infiltration on the larynx may advance to ulceration of the free edge, the anterior or laryngeal surface of the epiglottis. This ulceration may be either central or lateral in situation.

Anterior Commissure and the Subglottic Region.

The anterior commissure and the subglottic region are occasionally found to be the site of election of tuberculosis but this is the exception rather than the rule.

General.

Associated with a diseased larynx, the pillars of the fauces, the uvula and the tonsils may show tuberculous infiltration.

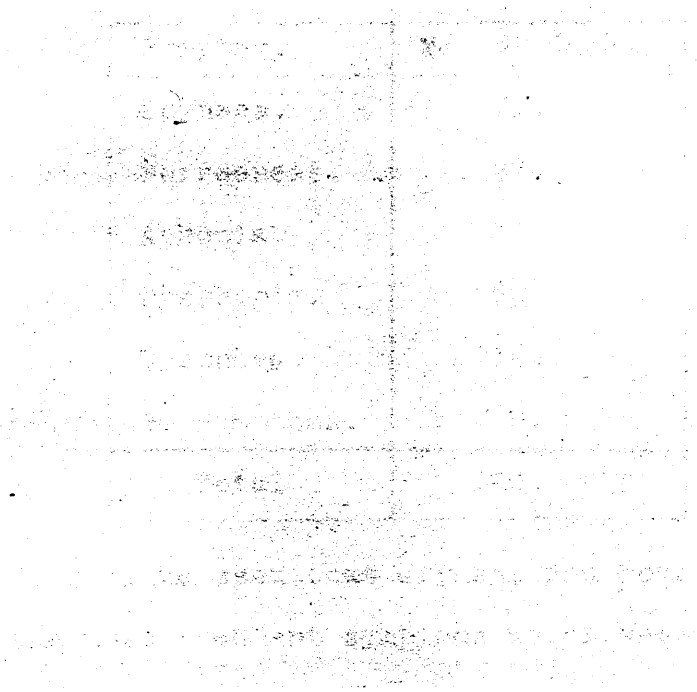
A rare and interesting complication of tuberculous laryngitis has been described by M.Dawson Tyson. He observed a case in which perforation of the thyreo-hyoid membrane was caused by tuberculosis of the larynx assisted by a secondary infection.

Lupoid Tuberculosis.

Lupoid tuberculosis is a much rarer manifestation than ordinary laryngeal tuberculosis.

Pale, very small lupoid nodules may form on any part of the larynx and those after a time break down into small shallow ulcers which show little or no discharge. Surrounding the ulcers there is sometimes a little congestion, but this is an inconstant feature. A few minute white scaly patches are sometimes to be found between the reddish areas.

Lupus of the larynx is usually associated with lupus of the mucosa of the nose, fauces or soft palate. In all cases it is accompanied by fibrosis and results in thickening, twisting and distortion of the normal laryngeal structures.



SYMPTOMS OF LARYNGEAL TUBERCULOSIS.

There are a large number of symptoms which occur in laryngeal tuberculosis. None of those individually can be regarded as typical of this disease. Only a consideration of all related symptoms in conjunction with the patient's personal history can be taken as indicative of laryngeal tuberculosis.

An analysis of the symptoms of the 100 cases reviewed showed the following frequency.

| Symptom. | No. of Cases. |
|---|---|
| Dryness. | 71. |
| Hoarseness. | 67. |
| Aphonia. | 39. |
| Dysphagia. | 22. |
| Dyspnoea. | 18. |
| No Symptoms. | 9. |
| Total | 226. |

It will be seen that dryness and hoarseness were the most frequent symptoms which were found. Dysphagia and dyspnoea occured in 22 and 18 cases respectively. In all cases these two symptoms were noted in pulmonary lesions of the Group III type (Turban-Gerhardt) and must thus be definitely regarded as a very grave development in laryngeal tuberculosis. In 9 cases, no symptoms whatever

were mentioned by the patients despite the presence of very obvious and definite laryngeal tuberculous infiltration. Cough was found to be a fairly common complaint but it was impossible to determine when this was laryngeal rather than pulmonary in origin.

HOARSENESS.

Hoarseness can be regarded as one of the commonest symptoms. All degrees of huskiness may be encountered varying from slight roughness of the throat on excessive singing and shouting to hoarseness on the slightest vocal effort.

This huskiness may be more obvious in some cases in the morning, whereas in others it is more pronounced at night. Again, the complaint of hoarseness is often an extremely variable symptom, being present one day and absent on the following inquiry.

It was generally believed that hoarseness was the initial symptom in laryngeal tuberculosis. This is disputed by R. Scott Stevenson and Caesar Hirsch.

The actual reason for the hoarseness in speech can be ascribed to a number of possible factors.

(1) William Hulse suggests that in tuberculosis there is a reflex tendency to hoarseness in order to keep the throat in a neutral position, as movement gives rise to pain and discomfort.

(2) A normal voice depends on enough muscular strength to force an adequate volume of air through the glottis. Thus a patient, tuberculous or otherwise, whose general condition is very poor and hence whose vital capacity is below normal often displays pronounced hoarseness in speech.

(3) It is often noted that pulmonary phthisical patients who have had an artificial collapse induced for therapeutic reasons and who have no laryngeal lesion, are subject to hoarseness. This is, according to Hulse, due to the mediastinum being displaced to the contralateral side. Further evidence of this symptom following collapse therapy is to be observed when small quantities of air are aspirated from the affected side when the symptom of huskiness is relieved.

(4) Barwell suggests that huskiness arises in some cases partly from the strain of excessive coughing and partly from the infection of the larynx by secondary organisms present in the sputum. When huskiness is directly attributable to tuberculous disease of the larynx, certain structures show a higher frequency of involvement.

VOCAL CORDS.

Almost all degrees of involvement of the vocal cords except the most insignificant, give rise to some degree of hoarseness. Generally, the larger and deeper the ulcer the more profound the disturbance in the timbre of the voice. Healing of a vocal cord lesion may produce irregularity in the cord margins and also faulty apposition on phonation. This, may in turn give rise to impairment in the quality of the voice ranging from roughness to marked huskiness. Similarly hoarseness is to be found in cases showing infiltration and congestion of the vocal cords.

VENTRICULAR BANDS.

Oedema with or without infiltration of the ventricular bands may impair complete adduction of the vocal cords and thus produce huskiness.

ARYTENOID CARTILAGES.

Infiltration of the arytenoid cartilages as already mentioned may produce complete ankylosis of the joint and huskiness occurs due to immobility of the cord.

INTERARYTENOID REGION.

A small infiltration of this zone is frequently found without giving rise to any symptoms. A large tuberculoma or ulcer situated in this region may however give rise to hoarseness.

In the series of 100 cases investigated 67 complained of some degree of hoarseness in speech. This was,apart from dryness of the throat the most frequent symptom which was found.

DRYNESS OF THE THROAT.

Dryness of the throat is a frequent and often an early complaint in patients suffering from laryngeal tuberculosis. B.T. McMahon suggests that the cause of dryness may be due to a profuse secretion from the mucous glands of the larynx to relieve thirst in the advanced type of case. A s the patient is often troubled by

dysphagia this secretion is not swallowed but expectorated. The loss and diminution in fluid intake is believed by McMahon to produce dryness. This is not a very convincing explanation as many early cases of laryngeal tuberculosis suffer from dryness of the throat where there is no suggestion of dysphagia.

Of the 100 cases examined 71 complained of dryness of the throat. This was the most frequent complaint amongst the investigated cases.

APHONIA.

Patients suffering from laryngeal tuberculosis frequently complain of aphonia. This is often quite transient in character, but may in the advanced type of case become permanent.

Aphonia may be caused by infiltration of one or both cords, or oedema of the ventricular bands.

This was found to be a symptom in 39 of the 100 patients examined.

DYSPHAGIA.

This is a serious though not a common symptom which may develop in laryngeal tuberculosis.

Pain may be experienced on the external or internal surface of the throat or is occasionally referred to one or both ears. Dysphagia may be caused by the pain inherent in an inflamed or congested mucous membrane.

McMahon suggests that contraction of the aryepiglottic folds produces pressure on an inflamed perichondrium of the arytenoids and epiglottis and also irritability of the nerve endings. Further, the more acute pain experienced on swallowing fluids rather than solids, is he feels, due to the greater contraction of the aryepiglottic folds necessitated by the demand for a more rigid closure of the epiglottis to prevent fluids entering the air passages.

The amount of pain experienced by each individual may vary widely. A.E. Wigglesworth asserts that....."the amount of complaint made by the patient depends as much on the individual as the extent of the lesion". Generally patients with infiltration and ulceration of the extrinsic part of the larynx experience much more pain than when the intrinsic portion of the larynx is involved.

It should be mentioned that extralaryngeal tuberculosis, viz., tuberculosis of the tongue, tonsil, pillars of the fauces and palate may all give rise to dysphagia.

Of the 100 cases of laryngeal tuberculosis investigated, 22 complained of dysphagia.

NO SYMPTOMS.

Most phthisiologists and laryngologists have noted that patients with a definite tuberculous infiltration of the larynx, often experience no symptoms whatsoever. Nine of the 100 patients suffering from laryngeal tuberculosis did not complain of any symptom. Pathological disease of the larynx may thus be revealed only in the course of routine examination. This indicates the importance of routine laryngoscopy (indirect) in all cases of pulmonary phthisis.

Very occasionally, an extensively ulcerated larynx may be encountered and the patient may be conscious of little or no abnormality in his throat. Wigglesworth is of opinion that this suggests an anaesthetic form of the disease.

Dyspnoea.

This is an infrequent complaint in laryngeal tuberculosis. It may be pulmonary or laryngeal in origin. In the former, according to Torin, it is the result of extensive pulmonary infiltration which produces a diminution in vital capacity and thus dyspnoea.

Swallowing, which necessitates a short period of breath-holding accentuates the existing dyspnoea.

When exclusively laryngeal in origin it may be caused by ankylosis of one or both arytenoid joints with fixation of the vocal cords. Fixation of a single cord with oedema or infiltration of the opposite cord may similarly cause mechanical obstruction and reduction in the aperture of the glottis.

Dyspnoea may be gradual or sudden in onset. A gradual onset is more typical of the extending pulmonary lesion with a progressive diminution in vital capacity, though this cannot be taken as a hard and fast rule.

Eighteen cases of dyspnoea were found in the 100 cases investigated.

## DIFFERENTIAL DIAGNOSIS OF LARYNGEAL TUBERCULOSIS.

When patients suffering from pulmonary tuberculosis have a laryngeal examination, there is a tendency for the examiner to automatically classify the patient as one of laryngeal tuberculosis. Though frequently the case, this is not always a correct diagnosis. In addition, the possibilities of a second pathological condition occuring simultaneously with pulmonary tuberculosis must always be borne in mind. The following notes represent the barest outline of the salient points of distinction which are helpful in establishing a correct diagnosis.

### I. CATARRHAL LARYNGITIS.

Here the appearances are those of hyperaemia with some swelling and turgidity of the affected mucous membranes, which may in severe cases lead to actual ulceration. Usually, there is an accompanying history of some chill or exposure a few days prior to the clinical findings. In all cases, however, the involvement is a symmetrical one viz., both vocal cords or arytenoepiglottic folds being simultaneously affected.

When healing occurs, it takes place uniformly throughout all affected parts of the larynx.

In laryngeal tuberculosis, however, the involvement is asymmetrical and may reveal three or more stages of the disease - infiltration, ulceration and cicatrisation - present simultaneously in any one part of the larynx or scattered throughout the entire organ.

SYPHILIS. Mucous Patches.

Small slightly raised mucous patches may be found on laryngeal examination. Those are usually darker in colour than that of tuberculosis. It may be and often is asymmetrical in distribution and can be found in both anterior and posterior parts of the larynx though the former region is the more frequent site.

ULCER.

The ulcer margin does not as a rule show much granulation tissue and is well defined from the surrounding tissue. On examination the edges are found to be undermined and display a "crater" formation. This lesion is usually painless. Some authors point to this absence of pain as a distinguishing feature between the luetic and tuberculous infiltration. It should be noted that a small percentage of tuberculous

ulcers of the larynx may give rise to little or no pain.

CARCINOMA.

This condition is found more frequently in males over 40 years, though it can occur at any age. It may be found almost anywhere in the larynx though a frequent site of affection is the vocal cord. A single lesion which remains almost stationary is all that may be observed. Often the vocal cord may be immobile displaying little or no involvement of the arytenoid cartilage. Such a feature should always be viewed with suspicion. Again, though a tuberculous infiltration of the cord occurs more frequently in the posterior third, it is wrong to assume that disease of the middle or anterior zone is necessarily malignant or luetic in origin. Furthermore, any diagnosis of tuberculous laryngitis based on complete immobility of the cord should always be provisional and every opportunity for re-examination of the larynx in such cases ought to be taken.

The ulceration due to carcinoma is deep, with a punched-out appearance and its surrounding tissue may show signs of malignant infiltration.

LUPUS.

Lupus of the larynx may be accompanied by lupus elsewhere. Like tuberculosis of the larynx it may show ulceration and cicatrisation taking place concurrently in the same structure. However, in this condition, (lupus) cicatrisation and deformity in appearanceare usually the dominant feature. Frequently there is to be found an associated lupoid involvement of the nose or pharynx.

LEPROSY.

According to Mervin Myerson this disease resembles lupus but is always secondary to an existing involvement of the skin by leprosy.

TUBERCULOSIS.

The characteristic features of laryngeal tuberculosis may be summarised as follows:-

(1) Catarrh and congestion limited to one part of the larynx and usually lasting for some considerable time.

(2) A hyperplaesia of mucous membrane with a surrounding zone of congestion of the interarytenoid area, the "arytenoid", the aryepiglottic fold or one side of the epiglottis.

(3) The asymmetric distribution of the lesion.

(4) The rarity of complete immobilisation of a vocal cord.

(5) The high frequency rate of the lesion on the posterior structures of the larynx.

Despite the above characteristic features, laryngeal tuberculosis can occasionally show an atypical form. Diagnosis may then present considerable difficulty.

In regard to the differential diagnosis of laryngeal tuberculosis; two points deserve emphasis.

Firstly, - and here one can do no better than to quote Blegvad...."The differential diagnosis of tuberculosis, cancer and syphilis is not the most important thing in patients with pulmonary tuberculosis. The main point is to make the diagnosis of laryngeal tuberculosis as early as possible, as the sooner the treatment is commenced the better are the chances of cure".

Secondly, - it is by no means unknown, though it is uncommon, to encounter tuberculosis and cancer, or tuberculosis and syphilis or even all three present together in an affected larynx.

The importance of not ignoring such a possibility is stressed by both Tucker and Shofstall. As a corollary to this it should be mentioned that the presence of pain as an early feature should not obviate the possibility of tuberculosis with or without carcinoma and syphilis being jointly present in the diseased area.

I. RADIOLOGICAL INVESTIGATION.

(a) Larynx. Henry Taylor and L. Nathanson suggest that the roentgen can detect minimal laryngeal lesion especially of the ventricle which might be clinically overlooked. They confess, however, that the roentgen does not always lend itself to the absolute differentiation between syphilis, tuberculosis, benign and malignant neoplasm.

(b) Chest. As the laryngeal lesion can be considered for practical purposes as secondary to the primary pulmonary condition, an appreciation of the typical malignant, syphilitic and tuberculous radiological appearances of the chest is helpful in making a diagnosis.

(i) Neoplasm. Carcinoma of the bronchus may give rise to hoarseness with aphonia, which may be confused with an early laryngeal tuberculosis. This condition (bronchial carcinoma) is rare under 35 years of age and the radiological findings are distinctive. Collapse of a variable portion of the lung with enlargement of the corresponding hilum is a frequent finding. The greatest opacity is near the hilum, and the adjacent periphery is found to be less opaque. Such findings are rarely encountered in pulmonary tuberculosis, where the opacity is usually more peripheral in distribution.

(ii) Syphilis. This is a rarity, but is a condition which can be occasionally encountered. It is of two types: Interstitial and Gummatous.
Interstitial Syphilis reveals shadows radiating from the hilum due to an extension along the lymphatic vessels. "This proliferation process", says Twinning, "is most marked in the perihilar region and in the lower

lobes. There is a marked tendency to subsequent fibrosis and shrinking: bronchiectasis may occur."

The Gummatous form is described by the same author as a number of small or large miliary nodes scattered anywhere in the lung fields, and are of slow growth.

(iii) Tuberculosis. There are several early radiological forms of pulmonary tuberculosis which may be observed.

(a) The Assmann focus is situated in the dorsal subapical zone. It is variable in size and is usually. round and homogeneous in appearance

(b) There may be merely a general loss of apical translucency.

(c) The small rounded mottled areas of Wessler and Jaches are to be found between the clavicles in early cases of pulmonary tuberculosis.

(d) Simon foci, which consists of small round or irregular spots with a fairly well defined outline, may be observed in the supraclavicular region.

As the lesion in pulmonary tuberculosis advances the radiological appearance may reveal the following characteristics.

PRODUCTIVE TYPE. In this form a variable number of small nodules linked by strands of fibrous tissue to the hilum may be noted.

EXUDATIVE TYPE. The appearance is usually that of multiple woolly, ill-defined areas which tend to coallesce. The infiltration may be defined as 'fine', or 'coarse' depending on the "grain" of the exudate. Frequently the centre of the exudate may develop cavitation. A varying degree of productive and exudative involvement is usually found together in most cases of moderately advanced pulmonary tuberculosis.

FIBROSIS. The radiological picture of healing is shown by fibrotic strands, which surround and encapsulate diseased areas. This may result in marked distortion of the adjoining structures.

Radiological signs of both healing and disease are often found concurrently in a case suffering from pulmonary tuberculosis.

II. BIOPSY.

A small portion of tissue excised from the affected area for histological examination may reveal the presence of giant-cell formation or a simple, malignant or syphilitic lesion. Joseph Greene, like George Wood is of opinion that there are dangers in such a practice in that a simple biopsy may activate a quiescent tuberculous focus and spread disease to the adjacent healthy areas.

III. WASSERMANN REACTION.

A positive result is helpful in establishing the possibility of a syphilitic lesion.

IV. BRONCHOSCOPY AND DIRECT LARYNGOSCOPY.

There are two advantages in making such an examination. Firstly, the aspiration and later examination of a small quantity of fluid from an affected bronchus may clarify a doubtful diagnosis. Secondly, the examiner may observe an ulceration or infiltration in the subglottic region or in a bronchus, which is more typical in appearance than the findings on indirect laryngoscopy.

V. BLOOD INVESTIGATION.

Blood Sedimentation Rate. It is generally accepted that an estimation of the blood sedimentation rate "though of value in prognosis in tuberculosis, has but little value in diagnosis".

The Costa Reaction, is claimed by Charles Rubinstein to be of value in differentiating between a simple catarrhal and tuberculous laryngitis.

VI. TUBERCULIN REACTION.

Isolated redness of a cord may be cancer in an early stage, or the aftermath of catarrh. Moritz Schmidt, quoted by Blegvad, has suggested the injection of a small dose of tuberculin to enable a satisfactory diagnosis to be attained. The presence of a tuberculous focus is shown by an area of redness at the affected part of the larynx.

## PROGNOSIS IN LARYNGEAL TUBERCULOSIS.

In 1880 Morell Mackenzie stated "the prognosis of laryngeal tuberculosis is always extremely unfavourable and it is not certain that any cases recover". At present a much more optimistic note on this once dreaded condition is sounded by almost all laryngologists.

Generally, the prognosis of a case of pulmonary tuberculosis with a superimposed laryngeal infiltration appears to be more serious than an uncomplicated pulmonary tuberculosis. Such is the opinion of Sir St.Clair Thomson, who suggests that a patient in Group I. (Turban-Gerhardt) with tuberculous laryngitis has a poorer prognosis than a patient in Group II. without a tuberculous laryngitis.

Statistical data as to the prognosis in laryngeal tuberculosis are at great variance. This is in part due to subjective differences in the estimation of a diseased larynx. (Some phthisiologists tend to regard a local catarrhal involvement of the larynx as an early tuberculous infiltration, whereas others regard such a lesion merely as a simple catarrh). More frequently the cause is to be found in the type of patient under observation, as some institutions make a

point of confining admission lists to early cases, whereas others may have to open their doors to tuberculous patients who are virtually on their death-beds.

Blegvad who has had an extremely wide experience of laryngeal tuberculosis found at Oevesund Hospital between 1916 - 1934, 1773 patients with laryngeal tuberculosis. In 404 cases the final result was not known. Of the remaining 1369 - 74% had died and 26% were still alive.

Five factors appear to influence prognosis:-

1. The Laryngeal Lesion.
2. The Pulmonary Lesion.
3. The General Condition.
4. The Age of the Patient.
5. The presence or absence of tubercle bacilli in the sputum.

It is an appreciation of all five factors which offers a reasonable explanation for the apparently contradictory findings often to be noted in an exclusive consideration of the laryngeal lesion. Occasionally true healing of the larynx is observed and yet the patient's general and pulmonary condition may progressively deteriorate until finally death may supervene.

The following case A W. male aged (28 years) illustrates this point. A man with a history of 18 months cough, dyspnoea, lassitude, and 10lbs. loss of weight during the preceding four months was referred to the dispensary. There was a history of huskiness without dryness of the throat or dysphagia. On admission to sanatorium he was found to have dullness at the right apical zone with bronchial breathing, increased vocal resonance and whispering pecteriloquy. Radiological examination revealed a large cavity below the right clavicle with fine exudative infiltration in the right mid-zone. The left lung showed a small opacity at the left mid-zone.

Indirect laryngoscopy revealed shallow, greyish-yellow ulcers about the middle of the left vocal cord. Both cords moved freely on phonation. As the patient's general condition after four weeks rest in bed continued to deteriorate, artificial pneumothorax was induced on the right side, but after a further fourteen weeks had to be abandoned due to increasing dyspnoea with each refill.

At the end of this period despite continuous deterioration in the patient's general condition, and the expectoration of increasing quantities of

sputum (all examinations showing the presence of tubercle bacilli), the vocal cord lesion had almost completely healed. Two weeks later the patient died. The necropsy findings, revealed a large cavity at the right apex, and extensive caseation throughout the right and left mid-zones. Apparently there had been an extension of the pulmonary condition with a diminution in the laryngeal involvement.

THE LARYNGEAL LESION.

The rapidity of spread of a laryngeal lesion is a very good indication as to the prognosis. A rapid extension throughout all extrinsic and intrinsic structures of the larynx is indicative of an almost certain fatal termination. A slowly progressive lesion which shows a tendency to chronicity usually suggests a favourable outcome.

The type of laryngeal lesion is an important guide as to the prognosis of the case. Marked oedema and swelling of arytenoids, aryepiglottic folds and ventricular folds with the latter overlapping the vocal cords has invariably an extremely poor prognosis.

The extent of the disease in the larynx is a factor of some importance. A localised type of infiltration has a much better prognosis than that revealing involvement of both extrinsic and intrinsic portions of the larynx. Of the 100 laryngeal cases of tuberculosis investigated 25 showed infiltration of three or more portions of the larynx.

In the group containing thirty-four single lesions there were no fatalities after a period of twelve months, whereas amongst those showing involvement of three or more parts of the larynx twenty died. This appears to suggest that the more extensive the laryngeal lesion the more serious the prognosis.

Generally the type of lesion which shows some local congestion or infiltration with very little oedema or ulceration has a good prognosis. This is particularly so, in lesions where the site of involvement is the interarytenoid space. The thickening and elevation of the mucous membrane in this area is usually of a very benign order. Twelve cases in this series showed localised infiltration in this site, of those nine showed marked clinical improvement after a period of 6 months on vocal rest. There were no fatalities after twelve months amongst those

twelve patients.

SITE OF LESION.

The site of the laryngeal lesion is an important factor in assessing the prognosis both as regards cure and the life of the patient.

Heaf is of opinion that the results are generally more favourable in the intrinsic than in the extrinsic portion of the larynx. Most authors have found the prognosis most favourable in the localised form of infiltration.

Lesions were classified along the lines suggested by F.R. Heaf, i.e. Extrinsic, Intrinsic, Localised and Lupoid.

I. EXTRINSIC. This incorporates the epiglottis, arytenoid cartilages and the aryepiglottic and ventricular folds.

II. INTRINSIC. This incorporates the cords and interarytenoid region.

III. LOCALISED. Where the lesion is confined to one side of the larynx or localised to one or two small areas on either side.

IV. LUPOID.

In a series of 80 cases personally investigated, where absolute vocal rest for a period of four to six months was undertaken, the following results were observed:-

| SITE OF LESION | NO. OF CASES. | NO. OF CASES CURED, MUCH IMPROVED AND IMPROVED. |
|---|---|---|
| Extrinsic | 22 | 7 |
| Intrinsic | 24 | 14 |
| Localised | 34 | 23 |
| Lupoid | o | o |
| Total | 80 | 44 |

The following standards for "cure", "much improved" and"improved" were taken.

CURE. No clinical sign or symptom of infiltration

MUCH IMPROVED. A lesion showing merely congestion very little ulceration or oedema.

IMPROVED. Improvement of a slight order in clinical signs or symptoms.

Thus among the 80 investigated cases, all of whom were treated by vocal rest, the most favourable result was obtained in the localised type of infiltration. A s the above table demonstrates it also appears that the intrinsic rather than the extrinsic form of laryngeal involvement was more amenable to vocal rest therapy.

A consideration of the individual parts which constitute the intrinsic and extrinsic laryngeal areas, indicates a considerable difference in their response to treatment.

INTERARYTENOID REGION.

As previously mentioned a lesion situated in the interarytenoid space is usually benign in form. There may be a thickening of the mucous membrane to form small flattened plaques or irregular nodules in this area. Either of those forms of infiltration may break down and the surface may ulcerate. Yet the ultimate outlook is generally much more favourable than a lesion situated elsewhere.

VOCAL CORDS.

The true vocal cords show a wide variety in the form of laryngeal lesion which may develop. Fibrous and ulcerative forms may be found to occur either independently or simultaneously on the cords. (In both forms of laryngeal infiltration the outlook is, however, appreciably better when the site of disease is on the intrinsic, rather than on the extrinsic portions of the larynx.)

EPIGLOTTIS.

Pallor of the epiglottis is found to occur with considerable frequency. However, like pallor of the soft palate it can probably be considered to be a secondary anaemia - a very frequent finding in phthisical patients. This cannot be regarded as a factor of importance in the assessment of prognosis.

The epiglottis alone may be the site of inflammation, without at the same time showing any accompanying ulceration. In such cases the prognosis can be regarded in a favourable light.

Inflammation of the epiglottis, however, may advance to a characteristic pseudo-oedema. Here the whole structure reveals a pink, swollen and tense appearance. Alternatively, the inflammation may advance and one or more ulcers may develop on the laryngeal surface or on the edge of this structure.

Occasionally cicatrisation occurs in the pseudo-oedematous form of the disease. The whole organ presents a twisted irregular appearance.

A late and serious development in tuberculosis of the epiglottis is perichondritis of the cartilage. This lesion is invariably

accompanied by profound dysphagia. The usual outcome of this type of infiltration is extremely unfavourable.

ARYEPIGLOTTIC FOLDS.

Tuberculous disease of the aryepiglottic folds may follow infiltration of the arytenoid cartilages, or the epiglottis. When such is the case the disease usually assumes the form of infiltration found in the initial laryngeal site viz: the arytenoids or epiglottis. Very occasionally the "primary" focus of infection in the larynx may be the aryepiglottic fold.

Generally, the prognosis may be regarded as being intermediate in severity between an affection of the arytenoid and epiglottic zones on the one hand and the interarytenoid and vocal cord regions on the other.

ARYTENOID CARTILAGES.

Here the sequence of events is similar to that of the epiglottis. Swollen arytenoids of the pseudo-oedematous type may develop perichondritis, and in such cases the prognosis must always be viewed as serious.

Heaf considers that a patient showing tuberculous disease of the aryepiglottic folds with

massive infiltration or oedema of the epiglottis, or pyriform swelling of arytenoids have a very bad prognosis. Under thirty years of age he regards the outlook as hopeless. Over forty years of age, he suggests that though the outlook is on the whole bad, moderate improvement does occasionally take place.

DEPENDENCY OF PROGNOSIS ON THE PULMONARY CONDITION

There is no question that the lung lesion plays an extremely important role in the prognosis of the laryngeal lesion.

H. Barwell states,..."If the lesions in the lung are in a curable stage, cure of the larynx is nearly always possible, and is probable if the lesion in the larynx is not far advanced." Certain types of pulmonary lesions, however, must be regarded as having a very adverse effect on the larynx. This is especially true of miliary pulmonary tuberculosis, which frequently leads to a similar haematogenous form of laryngeal phthisis. Again, as one might anticipate, a caseating lung showing extending cavitation is usually indicative of an extremely poor laryngeal prognosis.

There are, however, exceptions to the latter generalisation. This is well illustrated by the following case.

J.R., a male aged 35 years, was found on clinical examination to have dullness on percussion at both apices, bronchial breathing, increased vocal resonance, and whispering pecteriloquy. The diagnosis of bilateral apical caseation was confirmed radiologically.

Indirect laryngoscopy revealed a moderate sized shallow ulcer covering the posterior half of the left vocal cord.

Twelve months later, although two cavities about 1 inch and 1½ inches were to be seen in the roentgenogram at the right and left lung apices, the ulcer on the cord on laryngeal examination was stationary or even suggested a diminution in size.

A possible explanation of this finding might be the presence of a local laryngeal immunity as postulated by Blegvad. Whether such a hypothesis is justifiable must await more positive evidence.

Heaf and Mann suggest that the prognosis is more hopeful in the productive than in the caseating type of lung lesion. This finding may be in part conditioned by the frequent absence of bacilli from the sputum or the readier formation of fibrous tissue and consequent higher resistance of a patient suffering from productive pulmonary tuberculosis.

In the reviewed series of 100 laryngeal cases, 24 of the co-existing pulmonary lesions were fibrotic and 76 were caseo-fibrotic or fibro-caseous. In the former group there were 3, i.e. 12.5%, deaths, and in the latter 19, i.e. 25%, deaths, during the twelve months period of investigation. (vide infra.)

| Type of Pulmonary Lesion | No.of Cases | No.of Deaths | Percentage No. of Deaths |
|---|---|---|---|
| Productive | 24 | 3 | 12.5% |
| Caseo-Fibrotic or Fibro-Caseous | 76 | 19 | 25% |

When the 80 laryngeal cases, after a period of four to six months on absolute vocal rest, were arranged according to the Turban-Gerhardt classification, they showed the following response to treatment.

| Group. | No. of Laryngeal Cases | No. of Laryngeal Cases cured, Much improved and improved | Percentage of recovery in each group. |
|---|---|---|---|
| Grp.I | 4 | 4 | 100% |
| Grp.II | 34 | 28 | 82.3% |
| Grp.III | 42 | 12 | 28.6% |

Thus, the cure or improvement obtained by a course of vocal rest therapy in laryngeal tuberculosis appears to be in part dependent on the extent of the pulmonary disease.

GENERAL CONDITION.

Hanns Alexander has stressed the importance that must be attached to the general condition of the patient in any consideration of the prognosis in laryngeal tuberculosis.

Fluctuating temperatures, night-sweats, tacchycardia and loss in weight must always suggest a gloomy prognosis. Heaf lays particular stress on the importance of serial blood examinations viz: lymphocytic, monocytic, white cell counts and blood sedimentation rates, as valuable guides in determining the course of the disease.

AGE OF THE PATIENT.

Looper and Schneider, St.Clair Thomson and many other investigators have found that the prognosis was most hopeful in the older age groups.

A similar finding was observed in the 80 cases under review, who were treated by absolute vocal rest.

| Age Group | No. of Larynges Examined | No. Cured, Much Improved and Improved |
|---|---|---|
| 15-20 | 8 | 3 |
| 20-29 | 29 | 14 |
| 30-39 | 21 | 12 |
| 40-49 | 16 | 10 |
| 50-59 | 4 | 3 |
| Over 60 | 2 | 2 |

The response to treatment was most unfavourable between the ages of 15 and 29 years and to a lesser extent in the 30-39 age group. Over 40, and especially 50 years of age the percentage of "cures" and "improvements" recorded was much higher. Such findings are consistent with the results obtained by most investigators.

THE PRESENCE OR ABSENCE OF TUBERCLE BACILLI IN THE SPUTUM.

The presence of tubercle bacilli in the sputum is a factor of importance in any assessment of the laryngeal prognosis. Such a viewpoint is the natural corollary to an acknowledgement of the "direct" or "sputogenic" path as the most important mode of spread of the disease.

Of the 80 laryngeal cases placed on absolute silence sputum examinations were negative in 14 and positive in 66 patients. After a period of 4-6 months on vocal rest 12 of the former and 32 of the latter groups were cured or showed some degree of healing.

| | | No.of laryngeal cases cured, partly improved improved. | %age laryngeal cases cured, partly improved improved. |
|---|---|---|---|
| Tubercle Bacilli absent | 14 | 12 | 85.71 |
| Tubercle Bacilli present. | 66 | 32 | 48.45 |

Thus the prognosis in the 80 laryngeal cases following absolute rest therapy appears to be better as regards cure and improvement in patients with a negative sputum.

# T R E A T M E N T.

## General Remarks.

The treatment of laryngeal tuberculosis has undergone many changes in the course of the past sixty or seventy years. At first the tendency was for radical therapy to be employed. This was the era of epiglottidectomy, tracheotomy, and punch forceps. Then there was a reaction in the opposite direction, in view of the frequent sloughing and fresh activity produced. A much more conservative approach gradually came to be adopted. Some authors e.g. George B. Wood - even hesitating to use direct laryngoscopy in view of the possibility of trauma.

Of recent years, great attention has been devoted to the prophylaxis of this condition. This has included the routine examination of all laryngeal cases complaining of huskiness or hoarseness or any throat symptom which might be indicative of laryngeal tuberculosis. Many authors, have gone even further and advocated routine laryngeal examination of all cases of pulmonary tuberculosis. To-day, this has become the regular practice in almost all sanatoria.

General hygiene must inevitably play an important role in any review of the prophylaxis of pulmonary tubercle. Sanatorial therapy with fresh, dust-free air, rest, sunlight and regular meals affords those excellent conditions necessary to prevent the development of laryngeal tuberculosis. H. Mortimer Wharry suggests that when there is any question of a phthisical patient having any pathological lesion of the larynx, he or she should go to a santorium, even if the condition of the larynx has not been definitely diagnosed as tuberculosis.

The primary source of infection of laryngeal tuberculosis is rarely, if ever the larynx. Usually the primary focus of infection is the lung. Prophylactic measures to avoid laryngeal tuberculosis must thus involve some consideration of such pulmonary lesions as give rise to laryngeal spread. The close association of a positive sputum and laryngeal tuberculosis has already been outlined. Collapse therapy in some form, which closes the open cavity and alters the sputum from positive to negative or even to vanishing point, is bound to play an important factor in the control of tuberculosis of the larynx.

According to.....Mervin Myerson.....
"successful pneumothorax usually but not always prevents laryngeal involvement". Much the same view is taken by Dwortezky and Van Poole.

This remarkable finding was investigated in a series of 142 cases of pulmonary tuberculosis showing no laryngeal involvement, where collapse therapy was employed. Artificial pneumothorax was the method of choice in the vast bulk of such cases of collapse therapy and this was supplemented in five cases by phrenic evulsion. In only three of the 142 cases was any evidence of laryngeal infiltration observed i.e. 2.11%.

When the laryngeal involvement was related to the degree of lung collapse, the following results were noted.

TABLE 1.

| | Result of Collapse Therapy. | No. showing Laryngeal Infiltration. (After 6 months |
|---|---|---|
| Adherence of lung to mediastinum | 12 | Nil. |
| Broad Adhesion Band (which could not be severed.) | 12 | 3. |
| Complete or satisfactory collapse. | 118 | Nil. |
| Total | 142 | 3. |

The three cases of laryngeal infiltration were noted in the group showing "broad adhesion band" and all had positive sputa.

Only one death occured among the three cases showing laryngeal infiltration. The remaining two merely showed slight infiltration of the interarytenoid area.

Of the 142 cases under review 126 had a positive sputum. In 16 patients the sputum was negative.

When the above cases were tabulated according to the Ministry of Health circular (37/T) they revealed the following distribution. (Tables II. and III.)

Table II.

Classification according to Ministry of Health Circular 37/T.

BEFORE COLLAPSE

| | | |
|---|---|---|
| T. B. - | 16 | 11 . 267 % |
| T. B. + GRP. I. | 49 | 34 . 507 % |
| T. B. + GRP. II. | 72 | 50 . 704 % |
| T. B. + GRP. III. | 5 | 3 . 521 % |
| | 142 | 99 . 999 % |

Table III.

Classification according to

Ministry of Health Circular 37/T.

AFTER COLLAPSE.

| | | |
|---|---|---|
| T.B. - | 68 | 47 . 887 % |
| T.B. + GRP. I. | 42 | 29 . 57 % |
| T.B. + GRP. II. | 29 | 20 . 42 % |
| T.B. + GRP. III, | 3* | 2 . 11 % |
| | 142 | 99 . 987 % |

*( including one case - dead.)

It appears from Table I that when a complete or satisfactory collapse (in 118 cases) even with a mediastinal adhesion ( in 12 cases), was achieved, laryngeal tuberculosis did not occur. When however collapse was inadequate (broad adhesion band 12 cases) the possiblities of laryngeal tuberculosis developing were distinctly greater.

The only conclusion that can be drawn from the above findings is that a satisfactory collapse tends to prevent the development of laryngeal tuberculosis.

Palliative Treatment.

There are a considerable percentage of cases - where the infiltration is of a serious order. In such patients, dysphagia and dyspnoea are among the most severe complaints. Dysphagia can vary in intensity from occasional twinges of pain on swallowing irritating foodstuffs to the most acute pain on swallowing even the smallest quantity of bland fluids or solids.

A wide variety of treatment has been advocated - all calculated to give some measure of relief from dysphagia that most distressing of all laryngeal symptoms. Insufflation of anaesthesin and orthoform, cocaine sprays and gargles containing analgesics, have been utilised extensively.

Injections into the superior laryngeal nerve have been advocated by a large number of laryngologists.

The purpose of injection of the internal branch of the superior laryngeal nerve with alcohol is to obtain anaesthesia of the nerve.

Such an injection gives relief on swallowing. As this mode of treatment has been frequently described, only an outline of the technique will be indicated.

Material. 2c.c. Syringe, 90% Alcohol, 2%Novocaine

The patient is placed in the dorsal position with the neck suspended over a pillow. All anatomical structures of the neck are clearly defined - especially the thyreoid and hyoid cartilages and the thyreohyoid membrane. The great cornu of the thyreoid cartilage is palpated with the left index finger. A loaded syringe with 0.25 c.c of novocaine is inserted just inside the great cornu. Gentle movement on the needle is made until the patient experiences pain in the corresponding ear. The contents of the syringe are injected and the needle is left in situ. Then the barrel is charged with $\frac{1}{2}$ c.c. of 90% alcohol, and this too is injected into the nerve. The needle is then withdrawn. Only one side is anaethetised on each injection. The anaethesia lasts a variable period from three days to three weeks. Reinjection rarely meets with the same measure of success as the initial injection.

Occasionally the dysphagia is increased, possibly because of interfascial spread of the alcohol.

In view of the possibility of failure in injecting the nerve due to anatomical aberrations or faulty technique, exposure of the nerve with resection or injection with alcohol has been suggested by Anton Sattler. There has been no general acceptance of this method.

It should be noted that only part of the larynx is supplied by the internal branch of the superior laryngeal nerve; a small portion, the laryngeal part of the epiglottis and the base of the tongue, obtains its nerve supply from the glossopharyngeal plexus. Involvement of this portion of the larynx may account for some of the failures experienced by some laryngologists.

Of the 100 cases investigated, alcohol injection of the superior laryngeal nerve was carried out in 15 cases. Complete relief was obtained in 7 cases, partial relief was noted in 5 cases and no alleviation of symptoms in 3 cases. This mode of treatment was only initiated when all more conservative attempts at palliative treatment ( cocaine spray ) (gargling with analgesics, orthoform insufflations etc.) had failed to give relief. Thus, the injection of the internal branch of the superior laryngeal nerve with alcohol is a useful adjunct in the

palliative treatment of dysphagia in laryngeal tuberculosis.

Sir James Roberts has advocated injection of the submucosa with 1.60 carbolic solution in glycerine in cases of tuberculous laryngitis suffering from dysphagia. A number of successful results are cited in his article, the underlying principle being that "surface applications do not affect disease deep to the mucous membranes." His technique is to inject both the intrinsic and extrinsic portions of the larynx with carbolic solution in glycerine. The former site (intrinsic portion of the larynx in the proximity of the ventricle of the larynx) is attained by introducing the needle $\frac{1}{2}$" into the thyreo-hyoid membrane and running it along the inner surface of the ala of the thyreoid cartilage. The opposite side can be injected twenty-four or forty-eight hours later.

When infiltration of the extrinsic portion of the larynx occurs causing dysphagia, the following technique is advocated. The pharynx and larynx are sprayed with 5% cocaine and 1.1,000 adrenaline. A needle charged with phenol in glycerine is introduced above the hyoid bone slightly to the

affected side of the midline. The index finger of the left hand is then passed over the base of the tongue until it rests on the epiglottis. The needle is introduced deeply in this direction and the contents of the syringe injected. In both cases the phenol in glycerine is preceded by a small quantity of novocaine to give some preliminary anaesthesia.

The mixture employed by Sir James Roberts is:-

Rx.

| | |
|---|---|
| Acid Carbolic (1.60) | ½ drachm. |
| Glycerine | ½ drachm. |
| Sterile water | 4 ounces. |

½ c.c. is usually the dose employed.

Only five patients suffering from dysphagia were injected in this manner. Of those one gave marked improvement and one slight improvement; the remaining three showed no progress or deterioration.

INJECTION OF PARAPHARYNGEAL SPACE.

As mentioned above, injection of the superior laryngeal nerve may not completely relieve the complaint of dysphagia. This may be due to involvement of the lingual surface of the epiglottis or the base of the tongue, areas

which are not supplied by the superior laryngeal nerve. The nerve supply of the latter area is the pharyngeal plexus composed of branches from vagus, glossopharyngeal and sympathetic nerves, which are located in the parapharyngeal space.

Henry Schugt advocates injection of the parapharyngeal space to give relief in cases of pharyngeal tuberculosis.

This method has not, however, met with a wide acceptance in this country. Schugt and others have suggested the infiltration of the recurrent laryngeal nerve by injections of alcohol. The mode of approach being along the 1st. tracheal ring to within 1 - 1½ cms. of the vertebral column.

Wolfenden Method.

Most writers have remarked on the frequency with which the posterior wall of the larynx and its associated anatomical structures are implicated in laryngeal tuberculosis, and the rarity of infiltration of the anterior laryngeal wall. Hence the reason for the adoption of the Wolfenden position for feeding patients suffering from dysphagia. The patient lies in the prone position, his head and shoulders being suspended over the edge of the bed and meals are taken in this situation; fluids are sucked

through a straw. There is not the same contact with the affected posterior laryngeal wall. An adjustable headrest has been designed by C.D. Van Wagenen. This is supplemented by the use of a rectangular resilient pillow under the patient's thorax to give the maximum ease in this uncomfortable position.

Franklyn Schuster, Sir James Dundas Grant and Cotton-Cornwall all speak of the value of this postural measure in combating dysphagia.

TREATMENT OF DYSPNOEA.

Dyspnoea arises following reduction in the aperture of the glottis due to extensive infiltration of the vocal cords or perichondritis of the arytenoid cartilage with ankylosis, giving rise to extreme distress. The inadvisability of tracheotomy in this regard as a form of palliative treatment has been given prominence by a number of authors. F.C. Ormerod who reports four cases where tracheotomy was performed by him, states, "The amount of improvement achieved in the larynx appears to be very slight and is not sufficient to justify tracheotomy for therapeutic purposes." M. Vlasto indicates in his monograph the

difficulties attending closure of a tuberculous wound following tracheotomy. Similarly E. Wessely is sceptical about the value of this operative procedure. He states " es hat sich aber gezeigt , das die Tracheotomie nicht immer auch von günstigen Folgen für den Lungenprozess begleitet ist, besonders wenn eins grössere Expektoration besteht".

It is interesting to note that Walter Howarth advocates tracheotomy not merely for dyspnoea but also to rest the larynx. "I am amongst those who consider that in some cases tracheotomy is not only justifiable but advisable".

GENERAL HYGIENE IN THE TREATMENT OF LARYNGEAL TUBERCULOSIS.

There is no doubt that much benefit is derived by laryngeal cases following a period of sanatorial regime. The fresh dust-free air, the sunlight and the regular wholesome feeding all help to improve both the general and laryngeal condition of the tuberculous subject.

Suitable climatic conditions also undoubtedly favour the healing of tuberculous laryngeal lesions. Ruedi and Hudson note the excellent results obtained by the high mountain climate of the Rhaetian Alps. However, they stress the danger of referring advanced cases with perichondritis or ulceration from the lowlands to the mountains, as the co-existing dysphagia which is nearly always present in such condition is aggravated by the cold dry air.

TREATMENT OF THE PULMONARY LESION IN THE TREATMENT OF LARYNGEAL TUBERCULOSIS.

As already indicated under "prophylaxis", improvement in the pulmonary condition is usually accompanied by a corresponding amelioration of the co-existing laryngeal infiltration.

COLLAPSE THERAPY.

The value of all forms of collapse therapy on the pulmonary system has been recorded by many authors as one of the most promising of therapeutic measures. Dwortezky noted that several of his patients who had a "collapse" induced for their pulmonary lesion, and who presented a co-existing laryngeal lesion, showed

a definite improvement in the affected larynx. This he found especially true of the subacute type of laryngeal tuberculosis. As already indicated, tuberculous laryngitis is practically never a primary infection, but almost always secondary to the pulmonary infiltration. The most frequent cause of infection is due to direct contact with infected sputum. Therefore, any treatment which results in a positive sputum becoming negative, in the diminution or complete elimination of sputum, must have a very potent effect on the incidence of laryngeal involvement.

J.Dworetzky investigated 5,382 cases treated by artificial pneumothorax collected by himself and other authors. Of these cases only twelve revealed signs of laryngeal tuberculosis.

This is very substantial evidence, especially when it is borne in mind that artificial pneumothorax is often performed in active and progressive types of pulmonary tuberculosis,

where much destruction with caseation and cavitation of lung tissue has occured. It is not surprising that his conclusions suggest laryngeal tuberculosis as a definite indication for collapse therapy, excepting in cases of miliary tuberculosis.

Cooper and Benson investigated 106 cases of pulmonary tuberculosis with accompanying laryngeal tuberculosis where collapse therapy was instituted. They found that 43, or 40% showed improvement, and 63 or 59% revealed no improvement.

Their conclusions are interesting "...many of the patients classified as 'far advanced' can be greatly aided, life prolonged, and distressing symptoms alleviated...." Scott Stevenson and G. Mc D. Van Poole on the basis of their experiences draw very similar conclusions.

DIRECT TREATMENT OF LARYNGEAL TUBERCULOSIS.

Vocal rest is now accepted as the sheet anchor of treatment in laryngeal tuberculosis.

The principle underlying treatment of almost all forms of tuberculosis is primarily that of obtaining rest for the affected part. It is much more difficult to induce absolute rest in this site of infiltration. Normal respiration, whispering and phonation, all result in movement and vibration of the vocal cords. Thus, it is not a simple matter to give absolute rest to the affected structures. The method employed is to give the patient a pad and pencil and place him in an independent cubicle where there are no possibilities for conversation. A large notice with "ON ABSOLUTE REST" is often helpful in constantly reminding the patient of his own responsibility in carrying out treatment. Jerome Head in an endeavour to ameliorate the difficulty of conversation while on vocal rest has designed an artificial larynx. This has not, however, met with any general measure of acceptance.

The results of treatment by vocal rest have been described by Sir St. Clair Thomson, Th. Ruedi,(Davos,) B.T. Mc.Mahon, Frederick Heaf, Weidman and H.B. Campbell, R. Scott Stevenson, and a host of other investigators.

Sir St. Clair Thomson, whose name has always been closely associated with this form of therapy in a detailed and very objective study found the following results after treatment of 67 patients by vocal rest.

| No. of Cases. | Cured | Much Improved | Improved | As Before | Worse |
|---|---|---|---|---|---|
| 67 | 34.3% | 1.5% | 28.3% | 24% | 12% |

In a series of 80 cases personally investigated, and comprising all grades of laryngeal tuberculosis, the following results were obtained.

| | Cured | Much Improved | Improved | Total (Cured or Improved) |
|---|---|---|---|---|
| No. of Cases | 21 | 3 | 20 | 44 |
| Percentage | 26.25 | 3.75 | 25 | 55 |

The condition of the larynx in the remaining 45% was either stationary or deteriorated.

The 80 cases, when arranged according to the Turban-Gerhardt classification, showed the following distribution.

| | | |
|---|---|---|
| GRP. I. | 4 cases. | 5% |
| GRP. II. | 34 cases. | 42.5% |
| GRP. III | 42 cases. | 52.5% |

Thus, the type of case studied seems fairly evenly divided between the early and moderate stage on one hand, and the severe form on the other.

In this analysis of the findings certain factors must be borne in mind.

(I) The results depend in some measure on the opinion of the examiner. As there was no permanent photographic record available of each laryngeal case but only a pen sketch, some personal error is probably present.

(II) Some of the findings, viz. 'Improved' and 'Much Improved' are relative terms and are in some measure dependent on the absence or diminution of subjective symptoms, such as hoarseness, laryngeal discomfort, etc., on the part of the patient. Thus, again there may be a subjective error in the estimation of the effects of treatment.

(III) Patients in this survey underwent a period of 4 - 6 months silence. This is regarded as an optimal period for vocal rest therapy by most authors.

It is, however, a relatively short period in which to expect improvement in the general immuno-biological resistance in such a chronic disease as tuberculosis.

With those reservations the above findings are presented.

The final analysis indicates that a rather higher percentage (55%) were cured, much improved or improved following a period of vocal rest, and(45%), a somewhat smaller percentage, derived no benefit or remained stationary. The cases showing 'Cure', 'Much Improvement', or 'Improvement", when arranged according to the Turban-Gerhardt classification, gave the following distribution:-

| Group. | No. of Laryngeal Cases Cured: Much Improved: Improved. | No. of Laryngeal Cases | Percentage of Recovery in each Group |
|---|---|---|---|
| GRP.I | 4 | 4 | 100% |
| GRP.II | 28 | 34 | 82.3% |
| GRP.III | 12 | 42 | 28.6% |

It seems clear that the result of even the most conservative form of therapy indicates very broadly, that the more advanced the group classification, the more unfavourable the

prognosis vis-a-vis healing or even improvement of the larynx.

Further examination of those results showing the relationship between age groups examined and the frequency of laryngeal disease is interesting:-

| Age in Years. | No. of Larynges Examined. | No. Cured, Much Improved, Improved. |
|---|---|---|
| 15-20 | 8 | 3 |
| 20-29 | 29 | 14 |
| 30-39 | 21 | 12 |
| 40-49 | 16 | 10 |
| 50-59 | 4 | 3 |
| Over 60 | 2 | 2 |

Of the laryngeal cases which were placed on vocal rest the majority were in the age groups 20-29 and 30-39. However, the largest percentage of cures were recorded in the age groups 50-59 and Over 60 years of age. The prognosis in this series appeared to be most unfavourable in the age groups 15-20 and 20-29 years of age. Thus, the effects of vocal rest were most discouraging under 30 years of age, and more beneficial in the older age groups.

The effect of treatment (vocal rest) on the varying sites and types of lesions were then studied. Lesions were classified along the lines suggested by F.R. Heaf, i.e. Extrinsic, Intrinsic, Localised and Lupoid.

I. Extrinsic Area.

This incorporates the epiglottis, arytenoid cartilages and the aryteno-epiglottic and ventricular folds.

II. Intrinsic Area.

This incorporates the cords and inter-arytenoid region.

III. Localised.

Where the lesion is confined to one side of larynx or localised to one or two small areas on either side.

IV. Lupoid.

It should be noted that in this classification there is inevitably a certain overlapping because occasionally both extrinsic and intrinsic portions can be simultaneously involved in the same larynx. Thus, the following classification represents in some cases the dominant site or type of infiltration.

When "patients" on vocal rest were tabulated according to the distribution of the laryngeal lesions the following results were recorded:-

TABLE A.

| Site of Lesion. | No. of Cases | Percentage of Total Cases. |
|---|---|---|
| Extrinsic | 22 | 27.5% |
| Intrinsic | 24 | 30.0% |
| Localised | 34 | 42.5% |
| Lupoid | 0 | 0 |
| Total | 80 | 100.0% |

It will be noted that there were approximately the same percentage of extrinsic and intrinsic laryngeal lesions, viz., 27.5% and 30.0%. The localised type of infiltration constituted the largest percentage, namely 42.5% of all examined cases.

When the results of treatment by vocal rest were tabulated against the site and form of laryngeal involvement the following findings were obtained:-

Table B.

| Site of Lesion. | Cases Cured, Much Improved, and Improved. | | Cases Stationary or Deteriorating. | |
|---|---|---|---|---|
| | No. | PERCENTAGE | No. | PERCENTAGE |
| Extrinsic | 7 | 31.82% | 15 | 68.18% |
| Intrinsic | 14 | 58.33% | 10 | 41.67% |
| Localised | 23 | 67.65% | 11 | 32.35% |
| Lupoid | 0 | 0 | 0 | 0 |
| Total | 44 | 55% | 36 | 45% |

It should be noted that the following standards for 'cure', 'much improved,' and 'improved' were taken.

'Cure': No clinical sign or symptom of infiltration.

'Much Improved': A lesion showing merely congestion with very little ulceration or oedema.

'Improved': Improvement of a slight order in clinical signs or symptoms.

Amongst those cases showing involvement of the extrinsic portion of the larynx more than double the number of cases remained stationary or deteriorated (68.18%) as compared with those which showed cure, much improvement or improvement (31.82%).

Where the intrinsic part of the larynx showed infiltration the results were more favourable; 58.33% of patients responded and 41.67% showed deterioration or remained stationary.

A more precise analysis of the results of treatment on varying sites of the larynx was undertaken.

Table C.

| Site of Lesion. | No. of Cases Cured. | No. of Cases Much Improved | No. of Cases Improved. |
|---|---|---|---|
| Extrinsic | 1 | 1 | 5 |
| Intrinsic | 7 | 1 | 6 |
| Localised | 13 | 1 | 9 |
| Lupoid | 0 | 0 | 0 |
| Total | 21 | 3 | 20 |

The above Table (C) further illustrates the relative successes scored in treatment by vocal rest. Of the seven "extrinsic" cases benefiting from treatment only one was completely cured. Half of the "intrinsic" cases (7) were cured out of a total of fourteen, and more than half of the "localised" cases (13) were cured out of a total twenty-three under examination.

Thus, broadly speaking, it appears that the most satisfactory results, both as regards "cure" and "grades" of improvement were obtained in the "localised" type of infiltration. The worst results in both cure and improvement being obtained when the extrinsic portion of the larynx was involved.

Oils.

Of recent years two oils have held the field in laryngeal therapy - Chaulmoogra Oil and Cod Liver Oil. Their principle action appears to be the soothing and cleansing of the throat and the removal of mucopurulent secretion from the larynx.

Andrew Banyai, is however, of opinion that the curative value of Cod Liver Oil is due to the large amounts of Vitamins A and D, and suggests that the iodine content may have a potent influence on some of the toxic manifestations of tuberculosis.

The possibility that Cod Liver Oil might have an inhibitory action on the tubercle bacillus is suggested by the findings of Campbell and Kiefer. They cultured the bacillus on a potato medium soaked with Cod Liver Oil and found that after five weeks the bacteria presented degenerative changes.

Several interesting observations of Lukens

on the value of Chaulmoogra Oil are quoted by G.M. Van Poole:-

1. Chaulmoogra Oil gives relief from pain and dysphagia.
2. The relief produced is continuous in contra-distinction to that given by cocaine.
3. This form of therapy is neither unpleasant nor distressing.

However, George E. Wilson and others have indicated the possibility of pneumonic deposits following intratracheal instillations of Chaulmoogra Oil in petrolatum. Such a complication is caused by insoluble droplets, which, when not absorbed, may cause broncho-pneumonia.

The general consensus of opinion appears to be that both Cod Liver Oil and Chaulmoogra Oil do give some measure of relief in dry and husky throats, but it is doubtful if wider benefit can be claimed. It is difficult to give findings because most patients even those on the threshhold of death often maintain that they are "feeling better" following such treatment.

Cautery.

D.R. Gaskins states that cautery has been widely employed as a form of therapy in tuberculosis of the larynx, and the principle

underlying treatment is not that of attempting destruction of tuberculous tissue, but rather the stimulation of a reaction with the formation of granulation tissue which is necessary for the sloughing of the heat developed area. New blood vessels are formed, which grow from the periphery through the previously avascular tuberculous area.

An interesting experiment in this regard was carried out by G. Wood, when a low grade tuberculous lesion on the skin of a rabbit was cauterised, and three days after it was found to be surrounded by a zone of reaction which at the end of twenty days became fibrous tissue.

Two methods of electrocautery have been described.

(i) The searing of ulcerated areas with a blunt cautery provided that both cocainisation and cautery do not tax the patients' vitality overmuch.

(ii) The practice of igni puncture, which has attained very wide popularity.

Technique.

All treatment is performed under the guidance of the laryngeal mirror. Most authors agree that under direct laryngoscopy there is a danger in activating the tuberculous focus.

A sedative such as omnopon and scopolamine or bromides is given to the patient. This is followed by spraying the pharynx and upper larynx with a spray consisting of 10% cocaine and adrenaline, supplemented later by painting both the extrinsic and intrinsic laryngeal structures with this solution. After complete anaesthesia has been obtained the cautery point or the flat electrode are employed for puncture or for searing the ulcerated surface.

Several points should be emphasized.

(1) The cautery should only be used when white hot, otherwise the tissues adhere to the metal.

(2) Complete anaesthesia is essential.

(3) Several places may be simultaneously cauterised.

It should be mentioned that not all authors advocate the use of both the sharp pointed and blunt cauteries. W.E. Vandevere whilst praising the use of the cautery advocates the exclusive use of the sharp pointed electrode.

Scott Stevenson and Heaf urge that the cautery should not be indiscriminately applied, and never in cases where there is a high blood

sedimentation rate, high leucocytic, low lymphocytic count or where the patient is losing weight.

The effect of treatment by cautery on a group of cases investigated by Weidman and H.B. Campbell was summed up by them as follows:-

Of the 31% of their laryngeal cases which were cauterised, the results were satisfactory in 70% and unsatisfactory in 30% of their patients.

There are dangers in the most careful use of this treatment. Dr. Hanns Alexander, states that reactivation of the lung lesion can and does occur, and that it is often impossible to determine in just which cases such re-activation takes place. He instances cases where this has been observed in relatively "sound" lung lesions after minor cautery.

The two following statements by widely experienced authors are a clear presentation of the present opinion on the electrocautery.

"If the use of the cautery is not too enthusiastic and its limitations frankly recognised, its value appears unquestionable." Weidman and Campbell (vide supra).

Quite the opposite viewpoint is held by R. Scott Stevenson. He remarks, "In my own practice I tend to use galvanocautery less and less depending more on other methods of treatment."

Gold Therapy.

According to George B. Wood the action of gold salts on laryngeal infiltration is not due to the action of the drug on the disease itself, but acts rather by stimulating the reticulo-endothelial system and increasing general body resistance.

Hanns Alexander is emphatic that gold salts should be the first line of attack in the slowly progressive proliferating and ulcerating types of disease. In the frankly exudative rapidly advancing form of infiltration he believes that treatment can only be determined on a consideration of the merits of each individual case.

H. Jessen and R. Griesbach who have had a wide experience of the action of heavy metallic salts on laryngeal tuberculosis, record twenty-three cases, of which one-third received benefit. They never encountered any unsatisfactory secondary effects, and in some cases observed a simultaneous improvement in the pulmonary condition.

Quite the opposite point of view is expressed by C.R. Griebel, who is of opinion that the great expectations anticipated from gold therapy, following successful animal experiments, have not, generally speaking, been fulfilled. He records improvements in a series of cases, but also notwithstanding small doses, obtained marked local laryngeal reactions with deterioration of the patients' general health.

A very similar attitude is expressed by Gustav Wotzilka after experience with several gold preparations. He has never noted an obvious improvement in the laryngeal condition which could be attributed to gold therapy.

ULTRA VIOLET THERAPY.

The value of ultra violet light as a therapeutic measure has been a source of acrimony in the field of laryngeal tuberculosis. Following its introduction into the armamentarium of phthisiologists there were a wide number of reports which spoke in glowing terms of its curative value. Of recent years opinion has been more sceptical as to its value. An almost specific action by actinotherapy has been claimed in a variety of forms of tuberculous sinuses,

cervical adenitis, etc. It was thus only a matter of time until the effects of Ultra Violet light on laryngeal tuberculosis were investigated.

Two modes of treatment have been adopted - topical and general. In the former, a wide variety of applicators have been employed. Reflecting mirrors have been used by some actinotherapists to direct the beam on to the infil - trated laryngeal area. Others have devised a technique whereby the patient, by reflecting mirrors, can himself apply treatment to the affected part.

Opinion is so varied on the effect of ultra violet therapy that one cannot do better than quote some viewpoints from a very extensive literature.

Dr, Hanns Alexander and E. Wessely are convinced that the use of ultra violet has now won a firm place in the treatment of laryngeal tuberculosis.

Austin Furniss also speaks highly of the curative value of ultra violet therapy in this condition. Similarly, G. Wotzilka summarises his conclusions by reiterating his faith in the radiation of laryngeal tuberculosis by the Cemach technique. In this he finds a very useful therapeutic measure, which especially in

conjunction with the electrocautery shortens the period of treatment.

Perhaps the most optimistic praise for this form of therapy is expressed by G. Strandberg and J. Gravesen. Among ambulant cases alone, Strandberg reports 55% healing with the ordinary Carbon Arc light baths. (The number of cases treated is not mentioned in his article).

Dr. Gravesen in a series of unselected cases of laryngeal tuberculosis applied general ultra violet light as a routine measure. This was initiated by him on the patient's arrival at sanatorium unless there was an immediate indication for special pulmonary treatment, viz., Gold or collapse therapy, when light baths were postponed for a short period. Throughout, the patient was only permitted to whisper. Treatment was continued until the patient was afebrile, a fall in sedimention rate had occured and weight had shown improvement. The author noted that there was often a rise in temperature at the beginning of a course of ultra violet therapy, but stressed that this should cause no disquiet to the operator, as he had personally never witnessed any detrimental effects following such a reaction. Moreover, he does not regard a febrile patient as unsuited for such treatment.

Quite the opposite attitude is held by Miller who points out that as the penetration of the rays are only 1/10 m.m., one cannot expect subepithelial nodules to be benefited. Mervin Myerson and George Wilson both view the beneficial results obtained following actinotherapy with scepticism. R. Scott Stevenson is even more emphatic. He states that the results are variable and that probably as many cures would have been recorded by less troublesome methods.

Sir St. Clair Thomson, who has had an immense experience in the management and treatment of tuberculous laryngitis, is in no doubt as to the merits of this form of therapy. He states, " .....As to the attempt to concentrate sunlight - natural or artificial directly on a diseased larynx, any laryngologist who has seen the effect will realise how inefficient is the attempt to concentrate rays on the interarytenoid region; and any sanatorium worker who has looked on will satisfy himself that it would require very positive results to justify treatment so frequent and so fraught with discomfort, weariness and fatigue to the patient."

VITAMINS.

The administration of Vitamin C has been advocated by Dr. C. R. Griebel because of the low excretion of ascorbic acid revealed by phthisical cases. He suggests that the pathological changes of the upper air passages may be due in part to an avitaminosis. He administers, with this principle in mind, daily intravenous injections of Redoxon Forte and Benerva forte to his tuberculous laryngeal cases until the often enormous deficiency in ascorbic acid has been restored. The ulcers, he claims, epithelialise over in a short time due in part to an improvement in the appetite of the previously dysphagic patient. This treatment, he maintains, has proved especially valuable in the febrile and poor type of cases where big vitamin deficits could be demonstrated.

His conclusions are interesting, "....die Entstehung einer Schleimhauttuberkulose auf einer Schwächung und Läsion des oberflächlichen Epithels beruht, die sicher nach unseren Erfahrungen und Versuchen auf Vitamin B - Mangelerscheinungen zurückzufuhren ist".

# C O N C L U S I O N S.

The following conclusions emerge from this investigation on laryngeal tuberculosis.

(a) Collapse therapy is an important weapon in our armamentarium in the prevention of laryngeal tuberculosis.

(b) The response to vocal rest therapy is related to the extent of the pulmonary disease (Turban-Gerhardt).

(c) The response to absolute silence therapy is most satisfactory in the age groups 50 - 59 and over 60, and poorest between 20 and 39 years of age.

(d) The highest percentage of cure and improvement were recorded in the intrinsic and localised types of laryngeal disease.

(e) Dryness and hoarseness were the commonest symptoms found in the 80 investigated "laryngeal" cases.

(f) The commonest sites of both "single" and "multiple" tuberculous laryngeal lesions were the vocal cords and processes and the interarytenoid region.

(g) The results, following alcohol injection of the superior laryngeal nerve in a small series of patients (15) suffering from dysphagia due to laryngeal tuberculosis, were noted.

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