Acute laryngotraceobronchitis is a descriptive pathologic term for a disease of varied bacterial etiology. Despite its varied etiology the symptom complex generally fits into a definite pattern because the symptoms are produced by inflammation or obstruction of one or more of the breathing passages.

In past times it was generally assumed, and correctly so, that a child or an infant suffering from inflammation of the air passages or obstruction to breathing due to infection had diphtheria. That possibility should not be forgotten. Acute laryngotraceobronchitis, however, has occurred more commonly than has laryngeal diphtheria in recent years. It has been shown to have resulted from infection by hemolytic streptococci, Streptococcus viridans, Staphylococcus aureus, various pneumococci, Hemophilus influenzae and possibly on occasions by a virus.

The syndrome is seen in infants and children of all ages, but is more often a dangerous disease in children aged less than four years because of the relatively small size of the breathing passages. It is a disease most to be feared in those aged less than one year.

**Clinical Picture**

The symptoms at onset of the disease are usually the same as those of spasmodic croup: a harsh brassy cough, and inspiratory stridor. These symptoms are generally due to subglottic edema, sometimes to supraglottic edema. Unless the vocal cords are involved the voice is not hoarse. Whatever the involvement of the region of the vocal cords, the classic signs of laryngeal obstruction are present: retraction above the suprasternal notch and clavicles, and of the epigastrium. Retraction of the intercostal spaces with inspiration is also often noted.

These symptoms at first may or may not be associated with fever. The absence of fever may correctly suggest that one is dealing with a case of spasmodic croup. However, my colleagues and I have seen several children whose dyspnea after an afebrile
onset rapidly became very severe and who required tracheotomy within twelve to twenty-four hours after the onset. When dyspnea appears and increases in severity, fever and evidence of toxicity usually appear. If effective treatment is not instituted promptly, death may take place.

Pathology

As the name implies, acute laryngotracheobronchitis is an acute inflammatory process involving the larynx, the trachea and the bronchi. Often edema is the only pathologic change noted. Secretion soon appears, especially in the lower part of the trachea and in the bronchi, and causes considerable mechanical obstruction to breathing. The secretion may be thick, ropy, gummy and tenacious, and frequently causes bronchial obstruction and atelectasis (fig. 1). Inflammation and edema of the subglottic region are responsible for most of the symptoms of laryngeal obstruction.

FIGURE 1: Purulent secretions obstructing a bronchus (hematoxylin and eosin x120).

FIGURE 2: Cross sections of bronchi showing obstruction with thick secretions.
ACUTE LARYNGOTRACHEOBRONCHITIS

(fig. 2). Multiple regions of atelectasis may be present. The secretion may become so thick as to form a cast of the tracheobronchial tree.

Treatment

The treatment of acute laryngotracheobronchitis is based on an understanding of the etiology and pathogenesis of the disease. Thick secretions must be thinned, an infectious agent combated and constant vigilance maintained for evidence of respiratory obstruction. In few other situations is constant intelligent nursing care so important.

Thick secretions are most readily thinned by thoroughly moistening the air which the patient breathes. A steam tent or steam room is usually the most convenient and effective means for supplying moist air. Two or three steam kettles are usually necessary to provide humidity. The water should literally drip from the top of the tent or from the ceiling. The more modern mechanical humidifiers provide moisture without at the same time making the room uncomfortably hot. Their use is to be preferred to that of a steam tent or steam room.

Oxygen should be well moistened if its use becomes necessary, since unmoistened oxygen exerts an undesirable drying effect on the secretion of the respiratory tract. Mechanical vaporizers\textsuperscript{1,2} may be used in conjunction with an oxygen tent. Lacking one of these we recently have used two nebulizers instead. Distilled water was used as the fluid and an oxygen tank as the source of nebulizing force. In times past steam has been run into the oxygen tent by pipe or rubber hose. This method is cumbersome and unsatisfactory and may be dangerous. Moist cloths suspended in the partially filled ice compartment of an oxygen tent and moistened frequently provide sufficient moisture to maintain the humidity at 70 to 80 per cent. This, however, is not as high a humidity as is best to maintain.

It has been shown\textsuperscript{3} that carbon dioxide is an effective agent for liquefying bronchial secretions. A 2.5 to 4 per cent mixture of this gas with 20 per cent oxygen in a tent has been suggested for treating pneumonia. My colleagues and I have not used it but we think it worth trying.

We often employ sodium or potassium iodide as an additional aid in liquefying tracheobronchial secretion. Five drops of a saturated solution of one of these salts may be given three times daily to a child of two years, and three drops to a child of one year. Davison\textsuperscript{4} feels that the use of medicines is unnecessary if the inspired air is properly moistened and that the medicine may make the patient nauseated. We agree but we have seen children

\textsuperscript{1} Davison.
\textsuperscript{2} Davison.
\textsuperscript{3} Davison.
\textsuperscript{4} Davison.
who seemed to have been helped by the administration of one of the iodides. We have not tried to use any of the other so-called expectorant drugs.

It is essential that the patient's intake of fluid be maintained. If the patient cannot take fluids by mouth, they should be given by the intravenous or subcutaneous route. In infants at least 2 fluid ounces (60 cc.) per pound (0.5 kg.) per twenty-four hours should be given and in older children about 1 fluid ounce (30 cc.) per pound (0.5 kg.).

One or more small transfusions (100 to 150 cc.) of blood may be necessary as a supportive measure and to aid in combating the infection. The administration of concentrated blood plasma or blood serum has been suggested for its dehydrating effect on the laryngeal edema. We have not had any favorable results from its use in the few instances in which it has been tried. Concentrated human serum albumin might be tried.

Food may be given according to the child's desires. It is generally not desired during the acute phase except in liquid form.

It is very important that throat cultures be made. A suction apparatus such as was described several years ago to collect material for typing of pneumococci is useful in obtaining material from infants for bacteriologic study. If tracheotomy is done, cultures of the tracheal secretions should be made.

Appropriate chemotherapy or antibiotic therapy varies from case to case depending on the etiologic bacterial agent. Penicillin is readily available at the present time and is effective when used to combat infections due to most strains of streptococci, staphylococci and pneumococci. It should be administered every two to three hours intramuscularly or by continuous intravenous infusion. Suggested dosage would be 200,000 units (divided into eight doses) daily for a child two years of age. If penicillin in a beeswax-oil medium is employed it is wise to use 200,000 to 300,000 units daily.

We prefer the use of procaine penicillin if a long-acting penicillin is to be used.

Large oral doses of penicillin can be given. In such acutely ill infants as those having acute laryngotracheobronchitis, one generally cannot depend on the oral route to provide adequate blood levels of the antibiotic agent.

Only rare strains of Hemophilus influenzae are killed by the use of penicillin. In fact one of the early uses of penicillin was to incorporate it in mediums on which Hemophilus influenzae was to be grown in order to kill off the other organisms which often overgrow it. Hemophilus influenzae infections respond well to the use of streptomycin. A total of 0.8 to 1.0 gm. daily, given intramuscularly in four to eight divided doses, is suggested. A daily
dose of 0.5 gm. will suffice in an infant less than one year of age.

The sulfonamide drugs still are valuable therapeutic aids. Hemophilus influenzae infections sometimes can be treated successfully with sulfadiazine, as more often can those due to streptococci, staphlococci and pneumococci. If sulfadiazine cannot be tolerated by mouth it may be given subcutaneously in the form of a 5 per cent solution of the sodium salt. The usual precautions regarding the use of the sulfonamide drugs must be observed.

Tracheotomy is indicated if the patient's dyspnea increases and if signs of laryngeal obstruction become more marked despite the use of moistening apparatus. Evidence of extreme restlessness, cyanosis and fatigue also is an indication for tracheotomy. In addition demonstration by auscultation that there is diminished entry of air into both lungs is further evidence that the patient's airway has been greatly reduced in caliber. Tracheotomy is preferred to intubation. Ideally it is done after a bronchoscopic examination and after crusts and secretions have been sucked out through the bronchoscope and while that instrument is still in place.

Great care must be used when performing a tracheotomy on an infant to see that the incision is made at a sufficient distance below the larynx so that the tracheotomy tube will not irritate the subglottal region. When this precaution is not observed undesirable subglottal scarring may result.

After tracheotomy the air entering the tracheotomy tube must be kept moist; this aids greatly in the prevention of crusts that tend to form in the trachea. The same measures for moistening the air may be used postoperatively as preoperatively. My colleagues and I have found, however, that the use of a nebulizer

![Diagram](image-url)
as described by Albers is most satisfactory (fig. 3). A nebulizer is attached to a rubber tube that carries oxygen. The distal end is applied to the tracheotomy opening by means of a flexible rubber hose. Iams reported that a small rubber nipple with the teat end cut off is satisfactory for this purpose. In our experience this measure has been lifesaving. Subsequent bronchoscopic aspiration is often unnecessary; the tracheal secretions can be aspirated by a catheter because they are kept moist. Davison urged that, when the suction catheter is used, it should not be inserted beyond the tracheotomy tube. Occasionally it is necessary to aspirate more deeply. When this is done very often the tracheal wall is irritated.

Contraindicated Drugs

It is still felt by some physicians that the struggling dyspneic infant having laryngotracheobronchitis should be given a sedative drug. Such a practice is most unwise. While the infant is under the influence of sedatives the cough reflex is often suppressed, secretions accumulate in the breathing passages and the infant dies from suffocation. The sedative drugs obscure the signs and symptoms which might indicate a need for tracheotomy. Infants having laryngotracheobronchitis rarely struggle unless some obstruction to breathing is present. Therefore, the use of all opiates, barbiturates and other sedative or narcotic drugs is contraindicated.

Likewise it is not wise to administer atropine or its related compounds to an infant having acute laryngotracheobronchitis. Such drugs exert an undesirable drying effect on bronchial secretions.

Occasionally asthma and laryngotracheobronchitis have been confused. One might therefore be tempted to administer one of the so-called antihistaminic drugs. Because of their possible sedative effect and atropine-like action, their use is contraindicated in the treatment of acute laryngotracheobronchitis.

SUMMARY

Acute laryngotracheobronchitis is a disease of varied bacterial origin. It is a very serious disease but more so when it occurs in children less than one year of age. Treatment consists in providing adequate moisture in the inspired air, sometimes the use of expectorant drugs, the administration of the proper chemotherapeutic or antibiotic agent, and careful nursing. Tracheotomy is sometimes necessary. Suggestions have been made regarding indications for its need, performance of the procedure and the after-treatment of the tracheotomized child. Sedative and antihistaminic drugs are contraindicated in the treatment of acute laryngotracheobronchitis.
La laringotráqueobronquitis aguda es una enfermedad de origen bacterico variado. Es una enfermedad muy grave, pero aún más cuando ocurre en niños menores de un año de edad. El tratamiento consiste de humedecer adecuadamente el aire inspirado, del uso, a veces, de drogas expectorantes, de la administración del agente quimioterapéutico o antibiótico apropiado y de una asistencia cuidadosa. A veces es necesaria la traqueotomía. Se han presentado sugestiones relativas a las indicaciones para este procedimiento, la manera de ejecutarlo y el cuidado subsiguiente del niño operado. Se contraindican los sedativos y las drogas antihistamínicas en el tratamiento de la laringotráqueobronquitis aguda.

REFERENCES

4 Davison, F. W.: Personal communication to the author.
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