

RÉSUMÉ

Les antibiotiques sont des agents thérapeutiques de découverte; ils agissent de façon remarquable dans certaines infections. Cette action, toutefois, ne se manifeste que vis-à-vis de certains organismes spécifiques. Il faut, par conséquent, bien connaître ces organismes avant de décider l'emploi de ces médicaments. Lorsque la décision sera prise, il s'agira d'administrer l'antibiotique à des concentrations suffisantes et pendant un temps suffisamment prolongé. Le principe sur lequel s'appuie l'usage des antibiotiques permettra de nouvelles découvertes et probablement la mise en œuvre de produits beaucoup plus puissants.

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LARYNGO-TRACHEO-BRONCHITIS*

(A statistical review of 549 cases)

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THE disease which in the last decade has been termed, almost universally, laryngo-tracheo-bronchitis is one which is rarely seen in adult life. There are several sound reasons for this well-attested fact; the infant's larynx is peculiarly susceptible to reflex spasm, its structure is much less rigid and therefore more easily collapsed, and inflammatory oedema of the mucous membrane is much greater in relation to the diameter of the lumen than in the adult larynx and the airway is encroached upon to a greater degree. It is, however, not easy to explain the greater incidence of simple laryngitis in childhood except on the basis of a lower degree of immunity to respiratory infections in early life.

The term laryngo-tracheo-bronchitis, now generally adopted, is at best a diagnosis of convenience to describe a group of cases presenting the same initial clinical picture, but it is often inaccurate when applied to any individual case in the group. Actually only 12% of the authors' series were proved by laryngoscopic examination, autopsy or at operation, to have any involvement of the trachea or bronchi.

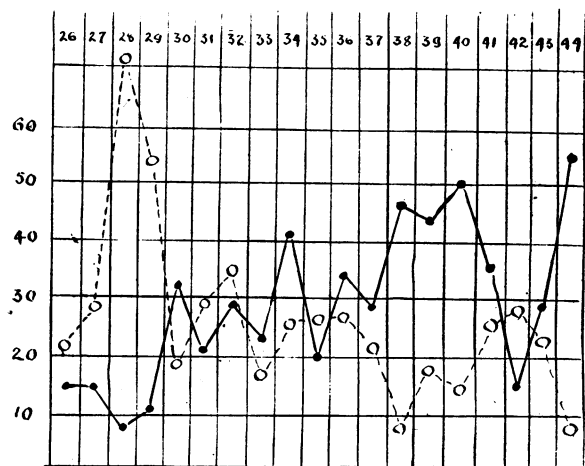
An analysis of 549 cases admitted to the Hospital for Sick Children from 1926 to 1944

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inclusive was undertaken with the hope that the data procured might throw some light on the etiology, and by noting past errors in diagnosis and medical and surgical treatment standardize the future management of this distressing condition. The series does not include any case of laryngeal diphtheria but does include cases of spasmodic croup whose condition was serious enough to require hospitalization.

In the last 19 years, 549 cases were admitted. Chart 1 shows in graphic form the number of admissions each year (solid line), and the mortality percentage (broken line).

CHART 1



There has been a steady increase in the yearly admissions from an average of 12 in the first four years to a peak of 55 in the last year. This cannot be explained by a corresponding increase in total medical admissions since these have increased only 50% in the same period. It is probable that the potential seriousness of the disease is now more generally recognized by the profession.

As has been pointed out by other observers, the mortality rate is usually in inverse proportion to the total number of cases in any given year. For example, in 1928 only 8 cases were admitted and 75% died, whereas in 1938, '39 and '40 when 46, 44 and 50 cases respectively were admitted, the mortality rate was only 8.7, 18 and 14% and in the peak year of 1944 there were 55 cases with a mortality rate of only 9.2%.

The sex incidence was similar to that in pneumonia, *e.g.*, 65% males and 35% females.

Age incidence.—In the series 69% were under 2 years of age and only 5% were over 6 years. These figures assume more importance when

estimating the prognosis. As will be shown later, the highest death rate is in the first few years of life.

Seasonal incidence.—This is essentially the same as for the common respiratory infections. Over 70% occur in the 6 months' period from November to April inclusive, the peak months being February and March.

BACTERIOLOGY

There seems to be no unanimity of opinion among recent observers as to the identity of the organism most commonly found by culture in this disease. Davies² from cultures taken ante-mortem reports the relative frequency as *S. hæmolyticus*, *Staph. aureus* and pneumococcus but in post-mortem cultures there was a marked preponderance of *Staph. aureus*; in fact all his fatal cases with one exception were due to this organism. McCready³ and Sinclair⁴ consider *B. influenzae* the most important causative agent. Walsh⁵ and Matthew⁶ found *Staph. aureus* in most of their cases but Jackson⁷ reports 85% of their cases infected by *S. hæmolyticus*. Neffson⁸ found the relative frequency to *S. hæmolyticus*, *S. viridans*, and *Staph. aureus*, the latter being relatively uncommon. In the more recent articles the possibility of virus infection is discussed.^{3, 9, 10, 11}

The diversity of findings is, no doubt, due to the fact that different organisms predominate in certain epidemics and in certain years. There is, too, a great variation in the methods of obtaining material for culture. Organisms recovered from a simple throat swab are often quite different from those grown from the site of the disease, during operation or at autopsy. In this study most of the bacteriological findings from 1926 to 1939 have been omitted for two reasons; the method of obtaining the material was by simple throat swab and the search was primarily to establish the presence or absence of Klebs-Loeffler bacillus. However, the cultures taken during this period during operation or at autopsy are recorded because of their greater accuracy. Commencing in 1940, all material was collected by the method described by Auger.¹² The organisms recovered by this method are, in a high proportion of cases, identical with those isolated at operation and give one a reliable picture of the bacterial flora at the site of the disease. During January and February, 1945, there was a sharp increase in

the number of cases admitted—55 in all—and although these have not been included in the general clinical survey they have been included in the bacteriological records.

CHART 2

	Alone	Mortal-ity %	In combination	Mortal-ity %
Strept. H.	53	28	34	30
Staph. Aur.	34	44	38	40
Pneumoc.	29	27	18	17
Strept. Vir.	13	15	9	44
B. Influen.	2	100	5	0
Mixture of organisms.	77	..	..	..
No growth.	20	..	..	..

Chart 2 shows the relative frequency of the organisms isolated from 1940 to 1945 inclusive. The material was obtained by Auger suction or by culture directly from the site of the disease at operation or post mortem.

CHART 3

	Alone	Mortal-ity %	In combination	Mortal-ity %
Strept. H.	28	50	18	50
Staph. Aur.	26	58	24	50
Pneumococ.	9	66	2	50
Strept. Vir.	10	20	8	50
B. Influen.	1	100	..	..
Mixture of organisms.	14	0	..	..
No growth.	13	0	..	..

Chart 3 shows the frequency of organisms recovered in the entire series by direct cultures from the site of the disease at operation or post-mortem and gives a slightly more accurate picture of the bacteriology than Chart 2. The relative frequency of the bacteria isolated is the same in both charts but the mortality figures for *Staph. aureus* and pneumococcus infections are higher in Chart 3. The number of instances where "no growth" or "a mixture of organisms" was recorded is of particular interest since it suggests virus infection. Although the mortality percentage of cases with combined infections was not as high as those with pure cultures, one combination *viz.* *S. hæmolyticus* and *Staph. aureus* proved to be a serious one with a death rate of 60%.

As suggested before, the frequency of various organisms varied from year to year. In 1940 to 1941 *S. hæmolyticus* predominated; in 1943 *Staph. aureus*, in 1944 pneumococcus and during January and February, 1945, epidemic nearly all the cultures were reported as mixed infection

or no growth. The belief that many of these cases are the result of virus infection is not based on mere speculation. Several facts tend to confirm it: (1) A specific virus of laryngo-tracheo-bronchitis has been identified by two Australian workers¹³ who used it in their experiments on chick embryos. (2) The frequency with which no common bacterial agent is recoverable by culture from the site of the disease. (3) The failure of penicillin or the sulfonamides to affect the course of the disease in the spectacular manner that is customary in those conditions ordinarily produced by pathogenic bacteria. (4) The postoperative convalescence in suspected virus cases is notably free from those difficulties which usually attend the cases due to bacterial infection. (5) The leucocyte count in suspected virus infections is frequently low. In 66 cases where "no growth" or "mixed growth" was reported 76% had leucocyte counts of less than 10,000 per c.mm. whereas in 87 cases in which a pure culture of either *S. hæmolyticus*, *Staph. aureus* or pneumococcus was reported, 66% had a leucocytosis of over 10,000.

There is considerable evidence to support the view that some of the cases are primarily infected by a virus with a secondary bacterial invasion several days later. A negative culture on admission and a positive culture of one of the common bacteria at the time of operation or post-mortem is a sequence of events which is suggestive.

From a bacteriological point of view it would seem logical to classify the cases into three main groups: (1) Virus infections. (2) Bacterial infections. (3) Primary virus with secondary bacterial infection.

The last group was more readily identified before the advent of sulfonamide therapy. The exhibition of this drug has to a great extent prevented a secondary invasion.

PATHOLOGY

The various types of pathological change observed in these cases are:

1. Simple catarrhal inflammation of the laryngeal mucosa, typical of the mild infections and of so-called spasmodic croup.

2. Inflammatory œdema of the laryngeal mucosa with or without muco-purulent exudate. This type of lesion is much the most common, being found in 66% of those cases

where the site of the disease was actually visualized.

3. Inflammation of the mucous membrane of the trachea and bronchi encountered in only 36%.

4. Denudation of the mucous membrane with formation of a gummy exudate. Such cases are included in the 36% mentioned above.

5. Inflammation with formation of a pseudo-membrane in the trachea. Contrary to the common belief this type of pathological change was infrequently seen, being recorded in only 16 cases, or 9% of the 181 cases where the site of the disease was visualized, and only 3% of the whole series.

Sections of tracheæ were examined microscopically in an endeavour to correlate the histological picture with a known pathogen—either virus or micro-organism. The result of this study was inconclusive. There seemed to be no uniformity in the type of inflammation produced by each organism but certain trends were apparent. Denudation of the mucosa was fairly characteristic of *Staph. aureus* infections, less so of *S. hæmolyticus* infections and rarely seen in suspected virus infections.

The relative frequency of bacteria producing a pseudo-membrane was *Staph. aureus*—3 cases; *Staph. aureus* and *S. hæmolyticus* combined 4 cases; *S. hæmolyticus* 2 cases and one each of pneumococcus and *s. viridans*. In five instances where a pseudo-membrane was found, no cultures were taken. These figures conflict with Orton's¹⁴ who found *S. hæmolyticus* to be the most common cause of pseudo-membrane.

CLINICAL PICTURE

The characteristic syndrome has been described by many writers, and the cases differ one from another only in the degree of severity. The onset, preceded as a rule by an upper respiratory infection, is sudden in about 75% of the cases, with a brassy cough and pyrexia of varying degree. The symptoms persist in spite of the usual palliative treatment and this fact tends to distinguish it from simple spasmodic croup. Recession of the soft parts is seen early but, contrary to the usual belief, is not always an indication of obstruction due to inflammatory œdema, since it is commonly seen in spasmodic croup. As the disease progresses indrawing becomes more marked and it then assumes more serious significance. There is a definite rela-

tionship, as pointed out by numerous observers^{15, 16} between the degree of recession and the situation of the obstruction; the greater the indrawing the higher up in the respiratory tract is the obstruction.

The course of the disease is unpredictable, many recover spontaneously in a few days, others progress until they present an alarming picture of respiratory obstruction, extreme restlessness, air-hunger, greyish cyanosis, rapid pulse, shallow respirations and hyperpyrexia, in other words anoxia and circulatory failure. The cause of the hyperpyrexia is not easy to assess. A temperature of 106° or more was recorded in 42 cases or 7.6% of the series, and was of very serious significance. These high temperatures are usually attributed to overwhelming toxæmia but there is no doubt that anoxia is to some extent responsible.

DIFFERENTIAL DIAGNOSIS

The only condition closely resembling L.T.B. is laryngeal diphtheria. This disease has almost disappeared in this locality. All children who have not received toxoid should be viewed with suspicion and given diphtheria antitoxin. Throat smears, cultures and laryngoscopic examination should leave little room for doubt. Inhalation of a foreign body is excluded by the history of onset, fluoroscopic and x-ray examination of the chest and by auscultation. A few cases of L.T.B. with "low-down" obstruction may simulate broncho-pneumonia. Such a one was admitted recently in a moribund condition. There was no history of croupy cough, cyanosis was extreme, and there was no indrawing. At autopsy the larynx was found to be moderately inflamed but below this point the lumen of the trachea and bronchi was occluded with a thick jelly-like material. Death was due to pulmonary collapse and anoxia.

TREATMENT

This will be discussed under two main headings:

A. Prophylactic.—With the advent of antibiotic drugs into the world of therapeutics it was felt that the answer to the prevention of this disease had been achieved. It was hoped that administration of one of these drugs to every case of simple croup would check the development of serious manifestations. Although the procedure has undoubtedly saved

many lives it has not been uniformly successful. Many cases develop so rapidly that the drug is not given a chance to control the infection; also many of the cases are the result of virus infection which is not affected by antibiotic drugs. The procedure is, however, of great value in the primary bacterial infections and also is an important factor in the reduction of mortality by limiting secondary bacterial invasion in the virus cases and by preventing serious postoperative complications such as mediastinitis and broncho-pneumonia.

B. Remedial.—Every case of laryngitis admitted to the Hospital for Sick Children is given so-called expectant treatment. The object of this treatment is to assess the rôle played by spasm or inflammatory œdema in the production of symptoms. Expectant treatment consists of: (1) placing the child in an atmosphere saturated with moisture. The steam tent is the appliance commonly used but it has certain disadvantages. The heat is oppressive and enervating and also tends to increase inflammatory œdema. Cool moist air as advised by Davidson¹⁷ is preferable but owing to the scarcity of electrical humidifiers during the war period this has been difficult to achieve. (2) Administration of sulfadiazine in doses ranging from 1¼ to 4 grains per lb. body weight depending on the severity of the symptoms; or penicillin 100,000 O.U. to 200,000 O.U. per day, or a combination of the two antibiotics. (3) Sedation with one of the barbiturates, preferably nembutal because of its more rapid action. Derivatives of opium are contra-indicated since they tend to dry up secretions. (4) Culture of the sputum by Auger suction. (5) A leucocyte count. (6) Removal of mucous plugs from the lower pharynx by gentle suction through a nasal catheter.

The administration of hypertonic human plasma as described by Baum¹⁸ has not, in our experience, proved of value. Oxygen is of help in combating cyanosis but must be used sparingly since it reduces secretions from the mucous membranes. If no amelioration of the symptoms occurs in one hour it is logical to assume that the obstruction of the air-way is due to causes other than muscle spasm. Operative interference now becomes a possibility. It is at this point that the services of the oto-laryngologist are required. His responsibility is that of determining the site of the obstruction, the

nature of the obstruction, the necessity for operative intervention and the type of operative procedure which offers the greatest hope of success.

INDICATIONS FOR OPERATION

A. *Medical*.—(1) Failure to respond to expectant treatment. (2) Increase in the degree of retraction of the soft parts. (3) Extreme restlessness and air-hunger. (4) Cyanosis. (5) Diminished air entry into one or both lungs. (6) Rapid thready pulse. (7) Fatigue.

B. *Surgical*.—The demonstration by gentle quick laryngoscopy of the presence of muco-pus, inflammatory œdema or membrane in the larynx, trachea or bronchi. If these pathological changes are slight, delay in operation may be decided upon but the patient must be watched by a resident specially trained for this task; if, however, they are severe, operative interference is advised and the choice must be made of three procedures: intubation, bronchoscopic suction and tracheotomy.

Intubation.—This procedure is impracticable in supra-glottic œdema and useless in low-down obstructions. If the obstruction is entirely in the larynx intubation may suffice. It affords at least temporary relief until a tracheotomy can be performed, and in a number of cases of simple laryngitis in our series intubation alone was followed by recovery. The intubated patient however requires unremitting attention. Prolonged intubation is contraindicated since it tends to increase inflammatory œdema and may cause ulceration and subsequent stenosis.

Bronchoscopic suction.—This is the method usually employed in those cases where laryngoscopy has revealed an adequate air-way in the larynx, but obstruction in the trachea or bronchi by muco-pus, pseudo-membrane or gummy exudate. It is our impression, however, that even in these cases a tracheotomy is to be preferred. Suction through the tracheotomy opening with a soft catheter can remove much of the semi-fluid exudate and bronchoscopic suction can still be performed if necessary, to remove thick plugs. A foreign body forceps is often required.

Tracheotomy.—If the severe air hunger has not been decisively relieved by the measures described above, tracheotomy should be performed forthwith. This may appear too drastic but it is the lesson taught by our long experi-

ence. Tracheotomy is not an operation to be feared. With proper precautions and technique the mortality from tracheotomy alone should be nil.

Tracheotomy is commenced by laryngoscopy and the immediate passage of an intratracheal catheter or relatively small bronchoscope. If, when the tube has been inserted, the patient's breathing is not relieved there is obstruction lower down; if an intratracheal catheter has been used it is pulled out and a bronchoscope at once inserted through which suction or forceps is used; if a bronchoscope has been passed a suction tube or forceps is passed through it and used until an airway has been achieved. Adrenaline or tuamine in isotonic saline may be found useful.

When the patient is moribund no anæsthetic is necessary. When the patient is able to struggle light anæsthesia administered through the intratracheal catheter or bronchoscope diminishes the dangers.

The tracheotomy is performed in the standard manner with a midline incision, but the bronchoscope or intratracheal catheter must be held exactly in the midline or the surgeon may cut through some muscles. This is especially important when the patient is an infant. To avoid future plugging use the largest possible tracheotomy tube. The blood vessels and isthmus ends are tied but the wound is left open.

A split pad of flat gauze, especially sewn as described by Jackson so that no ravellings can get down into the trachea, is slipped about the tracheotomy tube which is then covered with a moistened fluffy piece of gauze.

We agree with Jackson that a good procedure in dealing with an asphyxiated patient is to insert a bronchoscope and establish regular respiration through it and then perform a low tracheotomy in an ordinary manner. We are not in agreement with McCready³ that the bronchoscope used to facilitate tracheotomy causes pneumothorax. With experience in the technique of passing a bronchoscope, there is no need to do damage. This procedure has been followed many times in the hospital and in none of the patients who died from pneumothorax or mediastinal emphysema did autopsy show damage to the trachea from the bronchoscope.

In our opinion the intratracheal catheter has certain advantages over the bronchoscope. It is pliable. It is as readily passed as the bronchoscope and it can be held in position by a relatively inexperienced person while the tracheotomy is carried on. The size of the tube that is used, whether rigid or pliable, is of importance. It should be small enough to be passed without difficulty. It should never be so big that the larynx closes in spasm around it.

Instead of the bronchoscope causing pneumothorax its insertion should minimize the danger of pneumothorax and mediastinal emphysema; it very quickly eliminates the high intra-pulmonary pressure which de-

velops with severe laryngeal obstruction. In patients that are toxic or semi-moribund the passage of either of these tubes allows the tracheotomy to be carried on without anaesthesia of any kind. In other patients the anaesthesia may be local or general. With anaesthesia carried on by an experienced anaesthetist there is no danger, no damage, and tracheotomy is made very much easier.

Post-operative treatment.—Tracheotomy is not the end or the most difficult part of the surgeon's task. Alone, it will not cure cases of tracheitis or acute septic tracheo-bronchitis. It is the after-treatment which counts. The outstanding feature of the disease is, as Orton¹⁴ has said, the peripheral asphyxia; the plugging of the trachea and bronchi with heavy thick secretions which rapidly dry into encrusted flakes. The typical gummy plugs are undoubtedly due to secretions from exposed mucous glands following complete denudation of the mucosa as the result, in the majority of cases, of bacterial infection rather than virus. These plugs have been found during bronchoscopic examination before tracheotomy has been performed.

The ward treatment in brief, includes the following requirements: (1) Constant attendance of a nurse especially trained in the after care of this type of illness. (2) Availability of a surgeon or resident with apparatus for bronchoscopy and suction constantly in readiness. We have found of great value the Jackson-Tucker bendable aspirating tube. This instrument, with a little practice, can be passed through the tracheotomy opening and into either main bronchus without producing trauma. (3) Adequate humidity. (4) Suitable temperature. (5) Adequate rest for the patient.

CAUSES OF DEATH

The most frequent cause of death is anoxia with cardiac failure due to suffocation. The reasons for failure to relieve obstructions are manifold: (a) No operative interference is attempted. (b) The choice of operation may be unfortunate, e.g., intubation for a low-down obstruction. (c) Operation is delayed until too late. (d) Sudden aspiration of thick plugs may cause death before a bronchoscope can be passed. (e) The child may be in a moribund state on admission. (f) The accumulation of muco-pus or pseudo-membrane may be so extensive that any operative interference is unsuccessful.

The second most frequent cause of death is postoperative or preoperative infection outside

the larger air passages. Broncho-pneumonia, mediastinitis and septicæmia are the most common, occurring 16 times in the 106 deaths in this series. In the last six years such complications are becoming less frequent due to the action of antibiotic drugs, and this fact has removed much of the dread which formerly attended the operation of tracheotomy.

The third important cause of death is what appears to be an overwhelming toxæmia. This was a fairly common cause of death in the early years but has been noted only three times in the last five years.

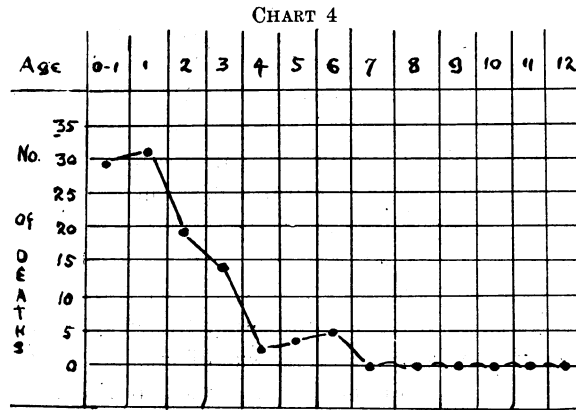
A few writers, notably Neffson,¹⁹ McCready,³ Simpson,²⁰ Richards,¹⁶ Johnson²¹ and Michels,²² have stressed the danger of pneumothorax as a complication of L.T.B. but it is surprising that many observers fail to even mention it. The mechanism of production of this type of pneumothorax has been ably discussed in papers by Iglauer,²³ Macklin²⁴ and Neffson.¹⁹ A rare eventuality but one that must always be kept in mind by the surgeon and physician is the occurrence of pneumothorax before operative procedure is attempted. Examination by fluoroscope and x-ray before operation should be made a routine procedure.

We can not agree with the statement made by McCready³ that the passage of the bronchoscope is responsible for most pneumothoraces. This series embodies a sufficient number of tracheotomies performed under each of several variations of technique to prove that deaths from pneumothorax are not caused by the bronchoscope or the intra-tracheal catheter or by the suturing of the wound below the tracheotomy cannula.

Instead of the bronchoscope causing pneumothorax its insertion should minimize the danger, it very quickly eliminates abnormal atmospheric pressures which develop with laryngeal obstruction. There were 8 proved cases of pneumothorax in this series. Seven followed tracheotomy. In one, the condition was discovered a few minutes after operation and probably preceded it; in another it was definitely diagnosed before any operative procedure was undertaken.

PROGNOSIS AND MORTALITY

Age.—Chart 4 shows the importance which age assumes in estimating prognosis. It will be seen that 87% of all deaths were in children under 4 years of age.



HYPERPYREXIA

This was, in our experience, of serious prognostic importance. Of 42 cases who had a temperature of 106° or over, 37 died—a mortality rate of almost 90%; of 38 cases with a temperature of between 105 and 106°, 14 or 40% died.

CHART 5

	TOTAL NO. CASES	DIED	MORT. ALTY. %	% for 5 YRS.	OPER. ACTIVE CASES	DIED	MORT. ALTY. %	% for 5 YRS.
26	14	3	21		1	1	100	
27	14	4	28		3	3	100	
28	8	6	75	31.6	2	2	100	80
29	11	6	54		5	4	80	
30	32	6	19		4	2	50	
31	21	6	29		3	3	100	
32	29	1	34		5	0	0	
33	23	4	17	18	•	•	•	80
34	41	10	24		3	3	100	
35	20	4	26		•	•	•	
36	33	9	27		2	2	100	
37	28	6	21		7	4	57	
38	46	4	9	17	5	1	20	63
39	44	8	18		10	6	60	
40	50	7	14		3	2	66	
41	36	9	25		8	4	50	
42	15	4	27		4	0	0	
43	29	7	24	15	8	4	50	35
44	55	5	9		7	3	42	
45	41	1	2.5		4	0	0	

Chart 5 depicts the mortality rate for the years 1926 to 1944 inclusive and for the first two months of 1945. Two mortality rates are shown, that for all cases admitted in each year and that for the cases operated upon. The gradual reduction in the death rate is best shown in columns 4 and 8 where the cases have been grouped into five-year periods. The most striking reduction is in the cases operated upon from a high of 80% to a low of 35%. If one

were to eliminate from the statistics of the last 5 years those cases who were moribund on admission or those who died from a sudden aspiration of plugs before bronchoscopy was possible the mortality figures could be even further reduced.

SUMMARY

1. The case records of 549 children admitted to the Hospital for Sick Children from 1926 to 1944 have been analyzed and 41 cases occurring in January and February, 1945 have been included in part of the survey.

2. There has been a steady increase in the number of cases admitted, and the seriousness of the individual cases was in inverse proportion to the number admitted in any year.

3. The sex, age and seasonal incidence have been shown.

4. The relative frequency of bacteria isolated was *S. hæmolyticus*, *Staph. aureus* and pneumococcus. *B. influenza* was infrequently found.

5. There can be no doubt that many of the infections are primarily due to a virus. These are recognized by the lack of response to antibiotic drugs, failure to demonstrate pathogenic bacteria in the cultures, a normal leucocyte count or a leucopenia, and a fairly typical clinical course.

6. Pseudo-membranous inflammation was found most commonly in *Staph. aureus* infections; denudation of the mucosa in *Staph. aureus* and *S. hæmolyticus* infections, seldom in virus infections.

7. Antibiotic drugs are of value in prophylaxis and should be exhibited in every case of simple spasmodic croup. If given early enough they will probably prevent the development of serious manifestations in the bacterial cases, but will have little restraining effect on the virus infections. They will prevent secondary infections and reduce the incidence of serious postoperative complications.

8. Tracheotomy is the operation of choice and should be performed early in the disease, but subsequent bronchoscopic suction must be frequently resorted to if lives are to be saved.

9. Intubation cannot be recommended as an operative procedure except as a temporary expedient to relieve obstruction.

10. The postoperative management is the most precarious phase of the treatment and requires experienced nurses and the constant attendance of a trained bronchoscopist.

11. The principal causes of death are failure to relieve obstruction, overwhelming toxæmia, postoperative infection, pneumothorax and mediastinal emphysema.

12. Eighty-seven per cent of all deaths were in children under 4 years of age.

13. Hyperpyrexia is a serious prognostic sign.

14. The mortality rate has been gradually reduced in the last 20 years.

15. If one can control serious complications by chemotherapy, and severe toxæmia by early diagnosis and treatment, the only serious condition with which one has to contend is mechanical obstruction and this, with ideal facilities can be corrected in a large proportion of cases.

From the wards and laboratories of the Hospital for Sick Children, Toronto, with acknowledgment and thanks to the anæsthetic service and the Department of Pathology for help and criticism.

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RÉSUMÉ

549 cas de laryngo-trachéo-bronchite furent étudiés pour arriver à la présente discussion. Le sexe, l'âge et les rapports chronologiques de la maladie sont notés. Les agents microbiens en cause ont été le *S. hémolytique*, le *Staph. doré* et le *pneumocoque*; Le *B. de l'influenza* fut plus rare. Par ailleurs, il y a de bonnes raisons de croire que fréquemment l'agent causal doit être un virus. La formation de pseudo-membranes fut plus fréquente avec le *Staph. doré*; cependant, on observa la dénudation des muqueuses avec le *Staph. doré* également, mais aussi avec le *S. hémolytique*. Les antibiotiques sont très efficaces comme agents prophylactiques sauf lorsque la maladie est causée par un virus. La trachéotomie et les aspirations bronchiques ont leurs indications précises. L'intubation ne sera qu'une procédure temporaire. Les soins post-opérateurs demandent beaucoup de doigté et la collaboration fréquente du bronchoscopiste. Les principales causes de mort relevées ont été l'obstruction, la toxémie, l'infection post-opératoire, le pneumothorax et l'emphysème du médiastin. 87% des décès eurent lieu chez des enfants de moins de 4 ans. L'hyperthermie assombrit le pronostic. Depuis 20 ans le taux de mortalité a graduellement diminué.

JEAN SAUCIER

THE "SHOCK THERAPIES" AT THE ONTARIO HOSPITAL, LONDON

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INTRODUCTION

THE term "shock therapy" became popular in medical parlance following Sakel's report, in 1933, on the value of insulin therapy in the treatment of schizophrenia. His investigations showed that insulin, in doses large enough to produce hypoglycæmic shock and coma, was of considerable value in the treatment of schizophrenic patients. A few years later Meduna reported on the curative action of metrazol in the treatment of manic-depressive psychosis and schizophrenia. Metrazol, administered intravenously, induces an epileptiform convulsion or grand mal, followed by a transitory period of coma and mental confusion. In 1938 electroshock therapy, introduced by Bini and Cerletti, was added to the list of convulsive therapies. Although these two therapies are usually grouped under "convulsive therapy", electroshock is the one more commonly used.

The conservative attitude with which shock therapy has been regarded in the treatment of mental illness during the past few years, has been replaced in some centres by a more aggressive attitude, since the merits and dangers of the therapy have become better understood. Instead of occupying a position far down or last on the therapeutic list, it has, particularly in this hospital, been promoted to a very prominent position. It is the opinion from observations made at this centre, that shock therapy administered daily to the newly admitted patient with acute psychogenic delirium, commonly renders such patient free from the acute symptoms within three or four days. The necessity for prolonged continuous bath treatment, special nurses, gavage, etc., is thus eliminated entirely or to a great extent. This is particularly the case in the manic phase of manic-depressive psychosis, where the patient is often completely freed of all symptoms within a week, compared with months or longer in the preshock era; and in schizophrenic delirium, where the patient is very often relieved of his acute symptoms within a few days, thus rendering him more accessible to psychother-