

## **Laryngismus / by William Gay.**

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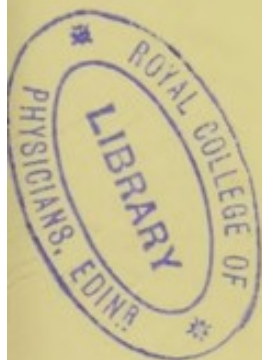


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# LARYNGISMUS.

BY

WILLIAM GAY, M.D., M.R.C.P.



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with an old student's kind regards.

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## LARYNGISMUS.

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COMING within the province of the laryngologist, the general and children's physician and the neurologist, laryngismus has been regarded from so many points of view, and has received such an amount of attention that clinically little or nothing remains to be told. A less fortunate result of this extensive study is seen in the numerous array of theories concerning the pathology of the disease, some of which are based upon insufficient observation, others are purely speculative, and not one indeed seems to adequately account for laryngismus in all its aspects. Under these circumstances I may perhaps be justified in bringing forward the present attempted explanation of a disease which has already been the subject of so much consideration. But before studying the nature of the affection it is necessary to emphasise some of its main characters and associations, even at the risk of repeating what has often been said before.

Certain definite facts are known concerning its etiology. All writers admit the important *rôle* played by rickets in this respect, though they differ to a certain extent as to the frequency of the concurrence of the two affections. Gee<sup>1</sup> believes that in nearly every case there is some evidence or other of the presence of rickets, and with this statement West<sup>2</sup> agrees. My own figures are identical with those of Gee (forty-eight cases out of fifty). Henoch<sup>3</sup> and Flesch believe that rickets is present in at least 75 per cent. of laryngismic subjects, Steffen<sup>4</sup> 90 per cent, but Goodhart<sup>5</sup> only found it twenty

<sup>1</sup> 'Batholomew's Hospital Reports' vol. iii. 1867.

<sup>2</sup> 'Diseases of Infancy and Childhood,' sixth edition, p. 192.

<sup>3</sup> 'Diseases of Children,' p. 71.

<sup>4</sup> 'Ziemssen's Handbook,' vol. vii., p. 107.

<sup>5</sup> 'Diseases of Children,' first edition, p. 250.



times in his thirty-four cases of laryngismus. It is possible that the statistics obtained from Great Ormond Street Children's Hospital (West, Gee's and my own) overestimate the frequency of rickets, for it is the exception there to find a child who does not present some of the features of that disease. Some of the discrepancy may probably be accounted for by the inclusion in one list of slight cases of rickets which would be ignored in another. It is to be remembered, however, that laryngismus does not necessarily fall most heavily upon those who have the most marked signs of rickets. Indeed, in some of the most severe cases I have seen, the only evidence of rickets consisted in beading of the ribs, delayed dentition, and a too patent fontanelle. Similarly laryngismus is very often conspicuous by its absence in those cases of rickets in which great thoracic deformity is the most striking feature. This is an important fact in connection with the theory entertained by Hughlings Jackson, and will be reverted to later on. After the publication of his paper I took notes of all cases of severely collapsed chests coming under my notice at Great Ormond Street during the laryngismic season, and not one was complicated with laryngeal spasm.

This season was independently brought into prominence by Gee and Fleisch,<sup>1</sup> though it had been noticed casually by some preceding writers and even by Hippocrates,<sup>2</sup> who, writing of the asthma of children (= probably laryngismus), says, "It occurs during winter in cities, whose confined situation precludes them from due exposure to the evaporating influence of the sun and winds," &c., &c. Of sixty-three cases observed by Gee during a course of three years, fifty-eight occurred from January to June (inclusive), and five only from July to December. This curious and important fact he interprets by supposing that "the weather necessitates the keeping of children indoors, and may be in one room for a long time, thus begetting a nervous erethism, which shows itself as a spasmodic diathesis." In very many cases such a history can be obtained, and the following case is a sufficiently

<sup>1</sup> St. Bartholomew Hospital Reports, vol. iii., 1867.

<sup>2</sup> Hippoc., *Fœsii Francof.*, 1621, p. 281.



striking illustration of it. A girl of six (the only living child) was brought to Great Ormond Street with severe laryngismus, which recurred each winter. On inquiry I found that she was kept in one room, swathed in flannels, with a fire night and day, and a screen in front of the door. In this way she was, as it were, hermetically sealed up for the whole of each succeeding winter. A "due exposure to the evaporating influence of the sun and winds," coldish baths and cod-liver oil soon relieved her of her laryngismus, and as the hygienic precautions were continued throughout the next winter, she suffered no relapse. An older brother, who had been coddled in the same way, died in an attack of laryngismus—a victim probably to misdirected solicitude. Very generally the same tale was told, "we thought it better to keep the children indoors in case they caught cold." So they were kept indoors and very often remained there the whole winter.

To what extent laryngismus is directly hereditary is of course difficult to determine, but it is common to find that its subjects are derived from a very neurotic strain. In eighteen of my own cases (fifty) there was ample evidence of such a neuropathic heredity. It sometimes happens that at the appropriate age, each member of a family is attacked with laryngismus. I have myself met with instances of this, but none so striking as those recorded by Reid<sup>1</sup> and Gerhardt.<sup>2</sup> According to the former authority, out of a family of fifteen only one escaped, and in ten the disease proved fatal, and the latter records an instance in which seven children were attacked out of a family of nine. In such cases there is probably a strongly marked neurotic heredity, and the children are all brought up under the same faulty hygienic conditions.

The most usual age at which the disease first occurs is from the seventh to the twenty-fourth month. Cases commencing some months before this should be regarded with a certain amount of suspicion, especially those dating from birth, of which an instance is recorded by Mackenzie<sup>3</sup>. On

<sup>1</sup> *Lancet*, May 1st, 1847.    <sup>2</sup> *Lehrbuch der kinderkrankheiten*, 1871, p. 285.

<sup>3</sup> 'Diseases of Larynx,' vol. i., p. 480.



the other hand it is not at all uncommon for laryngismus to recur every winter for four or five years, and sometimes even longer. As a rule more boys than girls are attacked; Steffen, from a large number of statistics, puts the proportion at two to one. My own figures, twenty-six females and twenty-four males, are too few to invalidate the general conclusion. No reason has yet been suggested to explain this greater proneness of males to the affection, but Hilton Fagge<sup>1</sup> recalls the fact that there is the same peculiar liability of males to tubercular meningitis, and regards the two observations as equally inexplicable.

There are many exciting causes. Paroxysms are common at any time during sleep, but especially so an hour or two after the child has been put to bed, or in the early morning. A passionate cry is almost certain to bring on an attack in a laryngismic subject; laughing much less surely. The act of swallowing frequently starts a paroxysm, which may thus come on as the child is sucking at the breast. Such attacks are generally only slight and represented by a simple crow. In severe cases, exposure to wind, sudden change of temperature, excitement, straining, as at stool, and sometimes even dandling in the arms are sufficient to produce laryngeal spasm.

The classical description of the paroxysm by Dr. West is too well known to need repetition. Some fail to recognise laryngismus unless all the severe symptoms there recorded are present, but incomplete forms of the disease are by no means rare. There may be no crow, even in some of the very worst cases and of this fact we were one day impressively made aware at Great Ormond Street. A strong healthy-looking child was waiting with his mother in the out-patient room, when for some reason it got into a passion, became blue and asphyxiated and was brought into Dr. Abercrombie's consulting room, dead, having practically died from temper. The child had had previous attacks when angry, but had never crowed. For these he was brought to the hospital and from the history we obtained at the time, no doubt was left in our minds that the case was one of

<sup>1</sup> 'Practice of Medicine,' first edition, vol. i., p. 787.



laryngismus. The spasm may be incomplete, so that sufficient room is present between the more or less closely adducted vocal cords to allow of the passage of air. In this case, there is a mere croupy sound with each inspiration, which produces only slight cyanosis and troubles the child but little. Older patients of from five to ten years sometimes experience a choking sensation on swallowing or crying, but there may be no croupy sound and only slight cyanosis.

A clue to all these cases is afforded by the contraction of certain facial muscles on mechanical irritation of the facial nerve branches—facial irritability.<sup>1</sup> Dr. Abercrombie was accustomed to point out to his students, when I first became his clinical assistant at Great Ormond Street, that on smartly brushing the forefinger an inch or so to the outer side of the external angle of the orbit, a contraction of the orbicularis palpebrarum ensued in cases of laryngismus, and that when pronounced the corrugator supercilii participated. I subsequently found that by percussion just below the malar eminence, contraction of the zygomatics, levator labii superioris proprius, levator labii superioris alæquæ nasi and pyramidalis frequently took place. Facial irritability is best obtained in cases of laryngismus with carpo-pedal contractions (= tetany). In them mechanical irritation of the main trunk of the nerve in front of the ear, causes a simple contraction of the before-mentioned muscles, exactly similar to the effect produced by the making or breaking of a fairly strong galvanic current. I have notes of sixty-four cases in which facial irritability was obtained. Laryngismus was present in forty-seven, and of these nine had convulsions, seven tetany, and one nutatory spasm of the head as well. Of the remainder, convulsions alone were present in one case, migraine in two, and tetany in one (an adult). In only eleven cases was no neurosis discoverable, and of these three had whooping cough, in which disease the neurotic element is fairly well marked. There were some signs of old or recent rickets in fifty-six cases, no evidence at all in four, and doubtful (on account of age of patients) in the four others. The most common age to obtain facial irritability

<sup>1</sup> See 'Tetany in Young Children,' by J. Abercrombie, p. 11.



is from the 7th till the 30th month, but it occurs occasionally at any rate till the twelfth year, and was present in the case of a girl of eighteen, the subject of tetany. Of the sixty-four cases, twenty-eight were males and thirty-six females. An interesting family, consisting of four girls may here be mentioned, in all of whom facial irritability was well marked at the same time. In two of them no history of laryngismus could be obtained, but the second child was supposed to have suffered the whole winter from whooping cough, which was almost certainly laryngismus, and the youngest was subject to severe laryngeal spasm. That a close connection exists between the two conditions can hardly be doubted from the following considerations. They both occur at the same period of life, are in some way or another both associated with rickets, are common during the first six months, and less frequently met with during the last six months of the year, and of my fifty cases of laryngismus, facial irritability was present in forty-seven. In many of these there was a gradually increasing difficulty in eliciting the facial irritability as the laryngismus improved, but as a general rule some slight contraction of the muscles could be obtained after all croupiness had disappeared. Finding the peripheral nerves of the limbs in a similar condition of increased excitability in all the cases of tetany that came under my notice, I tried those of laryngismic patients (who had easily obtainable facial irritability), and found that they were excitable to mechanical stimulation in direct proportion to their accessibility. The facial nerve always responded the more readily, no doubt because it was so superficial and very easily irritated by pressure against the underlying bone, and for these reasons it often happened that when the resulting contraction of the facial muscles was slight, those of the extremities did not respond at all. It is evident, therefore, that the importance of facial irritability is not limited to the area of the seventh nerve, but is significant of an increased excitability of probably all the motor nerves in the body, and this is of especial interest because it seems to bridge over and connect laryngismus with tetany as it occurs in children. For a long time carpo-pedal con-



tractions were included among the symptoms of laryngismus, but since they occur in the adult uncomplicated with any laryngeal spasm, they have been raised to the dignity of a substantive disease and dubbed tetany. Nevertheless, there is a close connection between the two affections, as they occur in children. They are both liable to come on at the same age in rickety children, both present the increased motor excitability (which is, however, much more marked in cases of tetany), and carpo-pedal contractions are almost always associated with severe laryngeal spasm.

Laryngismus is often complicated with convulsions. Of Gee's<sup>1</sup> fifty cases, nineteen had general convulsions, and Goodhart notices the same coincidence eight times in his thirty cases of laryngismus. Of my own cases nine had convulsions also. The question naturally arises, is laryngismus ever accompanied with loss of consciousness and does the spasm ever spread to the extremities and other parts, so that it is possible to obtain a serial gradation between laryngismus and fully-developed eclampsia? The observations of some good authorities would seem to point to an affirmative answer. Thus Sturges<sup>2</sup> asserts that not only is the diaphragm affected—sometimes alone, but that the limbs may be convulsed. The ocular muscles are reported to have participated in a case recorded by Cheadle,<sup>3</sup> and Henoch<sup>4</sup> asserts that spasm commencing in the larynx may spread to other parts of the respiratory apparatus—to the ocular muscles, masseters and temporals. He concludes by saying that "as far as he can judge, he believes that a short loss of consciousness occurs during severe attacks of spasm of the glottis;" but this must be an extremely difficult matter to decide. So, too, in regard to the limbs; in the convulsive and desperate efforts of the child to obtain air, it is quite conceivable that the limbs might assume positions simulating those found in general convulsions. It would seem safer therefore at present to suspend judgment on this matter until more evidence is forthcoming.

<sup>1</sup> 'Bart. Hosp. Reports,' vol. xi., 1875.

<sup>2</sup> *Med. Times and Gazette*, vol. i., p. 80.

<sup>3</sup> *Med. Times and Gazette*, 1880.

<sup>4</sup> *Loc. cit.*



It will be well now to briefly notice some of the many theories concerning the nature of laryngismus. Several of the older writers, *e.g.*, Rush<sup>1</sup> and Clarke,<sup>2</sup> maintained that the asthma of children consisted essentially of a convulsion, and many modern writers would be inclined to agree with this view of the case—as far as it went. Kopp,<sup>3</sup> in 1830, restarted the enlarged thymus theory, which had been previously suggested by Richa and Vendries a little more than a century before; but this received its *coup de grâce* from Trousseau,<sup>4</sup> who showed that no enlarged thymus was commonly found in cases of death from laryngismus, and that if enlarged, it was not necessarily attended with laryngismus.

In 1836, Ley<sup>5</sup> put forward the idea that enlarged glands in the neck and mediastinum were the source of the affection. This view is not yet extinct, but taught in a modified form by Goodhart<sup>6</sup> and Steffen.<sup>6</sup> The former considers that the laryngeal spasm is of central origin when rickets is well marked, but that those cases, in which rickets is not so striking a feature and there is cough with a laryngeal tone, bronchitis, or hoarseness, or all combined, are due to reflex irritation, arising from worry of the vagi terminations by enlarged mediastinal glands. There does not seem to me sufficient evidence to justify such a sharp distinction in the pathology of different cases of laryngismus. They vary very much in degree, it is true, but a slight paroxysm induced by passion is as clearly of central origin as that is reflex, which results from exposure to wind or colder air in more severe cases. In fact, in every case some of the paroxysms are no doubt centrally ordained, and others are as certainly of a reflex character. Steffen does not regard the enlarged gland theory as universally applicable, and evidently adopts it, *faute de mieux*. He suggests that the paroxysmal nature of the affection depends upon circulatory changes, which

<sup>1</sup> 'Dissertation on the Spasmodic Asthma of Children,' 1770.

<sup>2</sup> 'Commentaries on the Diseases of Children,' 1815, p. 87.

<sup>3</sup> *Denkwürdigheiten*, 1830, p. 1.

<sup>4</sup> *Clinical Med.*, *Sydenham Soc. Trans.*, vol. i., p. 353.

<sup>5</sup> 'An Essay on Laryngismus,' London, 1836.

<sup>6</sup> *Loc. cit.*



increase or diminish the size of the glands, and so also their pressure on the nerves. This explanation is constructed out of very problematical materials, requires a wonderfully fine adjustment of gland to nerve, and fails altogether to account for certain phases of laryngismus. Why, for instance, should the glands swell to the required extent on exposure of the body to a cold atmosphere, on emotion or swallowing?

Marshall Hall<sup>1</sup> was not long in applying his reflex theory to the elucidation of laryngismus, and although he pushed it too far, I am not at all sure that he did not recognise that some cases were of central origin. He arranged the reflex arc in schematic form, thus:—

<i>Excitors.</i>	<i>Centre.</i>	<i>Motors.</i>
Trifacial (dental)	Medulla	Recurrent of vagus
Vagus (gastric)		Intescostals
Spinal (intestinal)		Diaphragmatic.

This was a distinct advance upon previous efforts, and may still be accepted as a sufficient explanation of many of the paroxysms.

Elsässer<sup>2</sup> believed that laryngismus was accompanied with craniotabes, which allowed of pressure on the brain. This theory stands discredited for very much the same reason as Kopp's.

Probably no one would be found now-a-days to subscribe to Hood's<sup>3</sup> opinion that laryngismus was due to an enlarged liver impeding the descent of the diaphragm.

Hughlings Jackson has been the author of two theories in regard to laryngismus. In the first,<sup>4</sup> he regards it as a partial convulsion—partial, "because of the imperfect union of different sections of the nervous system." He has since discarded this in favour of a much more elaborate theory,<sup>5</sup> which is difficult to reproduce in a few words, but amounts practically to this: that the natural stimulant of the respiratory centre is venous blood, and that if for any reason there

<sup>1</sup> 'Diseases and Derangements of the Nervous System,' p. 71.

<sup>2</sup> *Der weiche Hinterkopf*, 1843, p. 161.

<sup>3</sup> 'On Scarlet Fever and Crowing Inspiration,' 1857.

<sup>4</sup> Reynold's 'System of Medicine,' vol. ii., p. 220.

<sup>5</sup> *Brain*, April, 1886.



should be a condition of super-venosis (as would result from a collapsed rickety chest), the ordinary rhythmical respiratory movement would be replaced by a respiratory spasm—which is laryngismus. My objections to this view are, (1) that laryngismic subjects have not necessarily collapsed chests; (2) that extreme cases of rickety chest are often met with in which there is no obtainable history of laryngismus; (3) that even when there is considerable collapse and inspiratory retraction of chest walls, there is rarely any external evidence of super-venosis, unless bronchitis or pneumonia be present; (4) that rickety children are liable to bronchial and pulmonary attacks of all kinds, in which there is decided super-venosis, but no laryngismus whatever; and (5) that although there may be no appearance of super-venosis just before an attack, it becomes more and more apparent as the paroxysm progresses, until the patient may become literally “black in the face.” According to this theory, therefore, a vicious circle is established. Super-venosis initiates the paroxysm, which increases the super-venosity, and laryngismus would consist of a single and necessarily fatal, gigantic respiratory spasm.

Efforts have been made, especially by Löschner,<sup>1</sup> to show that laryngismus depends upon hyperæmic states of the brain. Such are of course found after death, but the disease itself is so clearly of a functional nature that one need not here discuss these views.

Dr. Sturges<sup>2</sup> believes that “what saves from the fatal result of laryngismus is an answering spasm on the part of the diaphragm; a sudden enlargement of the chest cavity is thus made by the descent of the diaphragm, and it is met by a corresponding inrush of air, inflating the lungs—an inrush forcible enough to overcome the laryngeal closure, yet not without such resistance as may give rise to inspiratory stridor.” There seems no good reason, however, for supposing that laryngismus does not conform to the general behaviour of a convulsion (other than hysterical), in which the discharge of different centres is either almost instan-

<sup>1</sup> *Aus dem Franz-Josekinderspital in Prag.*, ii., p. 144.

<sup>2</sup> *Medical Times and Gazette*, 1885, vol. i., p. 808.



taneous or progresses rapidly from one to the other. No doubt the diaphragm often participates in the spasm of other parts of the respiratory apparatus, but if not at the same time, almost immediately afterwards.

It will be generally conceded that laryngismus consists fundamentally of a respiratory convulsion, whose point of departure is that portion of the centre which presides over the adductor muscles of the vocal cord. The respiratory centre taken as a whole is profoundly influenced by various emotional states, as is seen in sighing, "heaving of the chest," "feelings of suffocation," and "the holding of the breath" on impending danger. More important is the fact that the vocal cords seem peculiarly liable to be thus affected. Many a person experiences a "choking sensation" or "catch in the breath" on watching or reading of any thrilling scene, in making a sudden descent (as in going down the shaft of a mine), in facing a heavy wind, or at the moment of receiving a douche of very cold water. This spasm of the respiratory and laryngeal muscles, as the result of emotion, is infinitely more common among children, and is of far greater degree. Take, for example, the extreme case of a passionate child in a rage. He holds his breath, his face becomes darker and darker, his head is thrown back in the endeavour to get air, and his limbs may be rigid. Finally the spasm relaxes and air is frequently drawn in with a distinctly croupy sound. Every gradation exists between such an attack and simple crying or sobbing, in which there is clearly a laryngeal and phrenic element. Sometimes a perfect attack of laryngismus ensues in adults upon painting the interior of the larynx with some astringent, and those who have experienced the effect of "a crumb going the wrong way" will readily admit that a very severe spasm of the vocal cords may result from reflex action. All this goes to prove that the respiratory centre, and especially the laryngeal part of it, is not only reflexly excitable, but also unstable, owing to the influence exercised upon it by certain emotions, and broadly speaking, the younger and more emotional the subject, the more marked the instability. This tendency to respiratory and laryngeal spasm may be compared to many



of the other physical expressions of emotion, such as tremor, fidgetiness, blushing, and a desire to micturate through fear, all of which are due to a deficiency of control of the centre or centres which are under the influence of the particular emotion. Events which sometimes induce laryngeal spasm in adults inevitably bring on an attack in the laryngismic subject. Thus we have noticed that the chief exciting causes of the paroxysms are excitement, passion, crying, and exposure to wind or cold air. That the affection may sometimes be mainly of reflex origin is suggested by its occasional coincidence with sub-acute laryngitis, for of Gee's fifty cases, two only were not rickety, and both these had laryngitis at the time, and one of my own cases seemed to own the same origin. In regard to the occurrence of laryngeal spasm on straining, it should be noticed that the cords are naturally adducted during that act. But why should laryngismus occur on swallowing? It seemed to me that this could only possibly be explained by supposing that the cords were then normally adducted, and although the evidence I have been able to gather in support of this hypothesis is not conclusive, it is nevertheless highly suggestive. To Dr. Mount Bleyer, a laryngologist of New York, I would express my thanks for allowing me the use of the following unpublished experiment made by himself. He split open the thyroid cartilage of a dog and as it was awakening from the anæsthetic gave it food to eat. He closely watched the vocal cords and noticed that on each occasion of swallowing they were closely adducted. For leave to make use of another unpublished experiment telling in the same direction, I am indebted to the kindness of Dr. Semon and Mr. Horsley. The former writes me : ". . . . When we stimulated one of the centres for phonation, swallowing movements repeatedly supervened, and at the same time adduction of the vocal cords took place, whilst the larynx was raised *in toto*. On the whole it is easy to stimulate the phonation centre without exciting any swallowing movements." These results were only incidentally obtained in the course of experiment upon the cortical phonatory centres, I believe of monkeys,



but it may reasonably be inferred from them that adduction of the vocal cords is an associated movement in connection with the process of swallowing. Mount Bleyer's experiment shows that, in the dog at any rate, such is the case. More observations are required to corroborate this conclusion, which, if true, throws a considerable amount of light upon the pathology of laryngismus. The frequent occurrence of laryngismic attacks at night is difficult to explain. It will be noticed, however, that other respiratory disturbances are common during sleep, *e.g.*, asthma and cardiac and uræmic dyspnœa, and that even during healthy sleep there is a considerable modification of the respiratory process. Is it possible that the spinal centres are less fully controlled during sleep and in this manner rendered more susceptible to reflex or quasi-reflex influences? Let us consider in this respect the condition of affairs in connection with the urinary and sexual centres, about which more is known on account of their situation and liability to be affected by various diseases of the cord. Roughly speaking, both centres are normally under control, and, I take it, only discharge when that control is broken down, either by reflex irritation or impulses from centres above. An abnormal tendency to discharge, therefore, is indicative of a deficiency of inhibition, and that this is most marked at night is shown by the history of such affections as enuresis and spermatorrhœa. Both these conditions are nocturnal, when slight or of moderate degree, and only become diurnal as well when they have attained considerable severity, *i.e.*, when the controlling arrangements are so much the more defective. From this it follows that in such cases less powerful influences, reflex or central, are required during sleep to break down the control of these centres, than during the state of wakefulness. Experience shows that this is physiologically true also, and it is possible that the other centres of the lowest level, including those of respiration, are similarly less completely controlled during sleep. If this be true reflex and other influences would be more powerful, and slighter causes would be sufficient to induce laryngismic paroxysms at that time. Possibly an accumulation of mucus in the



larynx may act in this way, and it is noticed by many of the older writers as causing a "prodigious rattling in the throat," and setting up a paroxysm, unless noticed by the mother, who, by awakening the child, averts the attack. In this and many other ways, such as dreams, it is conceivable that laryngismus may be induced during sleep.

The healthy development of the nervous system in children demands that not only should new centres be developed, but that these and those previously existing should be appropriately restrained. To quote Hughlings Jackson:<sup>1</sup> "The higher levels being in the infant little organised . . . the lower level will be less 'controlled' or less 'kept down' than in older persons. *Pari passu* with the later development or evolution of the higher levels, the lowest will be more and more 'kept down.'" Mentioning Soltmann's researches on the defective inhibitory arrangements of very young dogs, he says, "if these be true, the younger the infant the more of an ordinary reflex mechanism will be what there then is of its nervous system, the less check will there be of one part by another . . . the respiratory centre will develop ahead of its checking nervous arrangements." Dr. Jackson further says: "It itself (*i.e.* the lowest level) in the infant will be at once *imperfectly developed and actively developing*, and thus naturally very excitable." I submit, however, that this excitability of the infant's nervous structure does not depend upon any inherent extra-explosiveness of the developing tissues themselves, but is the natural result of the development of the centres "ahead of these checking nervous arrangements." That this is so is strongly suggested by Soltmann's experiments, which, although carried out in regard to the organic centres only, are probably applicable also to those of higher degree. For if it be true that the direction of the evolution of the nervous centres is from the humblest to the most highly organised, and that the lower are "kept down" and "controlled" by those above, it necessarily follows that at the time of its evolution no centre is fully controlled. Here,

<sup>1</sup> *Loc. cit.*



it seems to me, lies the secret of the instability of developing nervous structures and their more ready response to reflex influences. For the same reason the brain during infancy is less able to resist disturbances to which it may be subjected, than at a later period of life when the centres are more fully under control. As Dr. Jackson remarks of the three great organic functions—digestive, circulatory and respiratory—the last-named will be the most actively developing during infancy. It will thus be of the three the least fully controlled, and will be still further weakened as the child commences to experience emotion, which has already been noticed as exercising a profound influence upon the respiratory centre in the way of diminishing its inhibition. But at the same time there is another most important factor to be considered. The faculty of speech is being developed, and *pari passu* will be developing the correlated functions of the vocal cords. To what extent the adductors of the cords participate in the respiratory process is not yet determined, but it is certain that they chiefly subserve the function of phonation. Their centres will be actively developing, and therefore feebly controlled during the period of infancy. For these reasons, the inhibition of the respiratory centre is much less complete than that of the other organic centres, and expressions of this deficiency of control are to be found in the intensity of the act of sobbing, and those quasi-laryngismic attacks in children, who are passionate, but otherwise healthy. As the child grows older the respiratory centre is more and more “kept down” by the development of its inhibitory arrangements, but the occurrence of slight laryngeal spasm in some adults, as the result of emotion, shows that complete control may never be attained. The coincidence of severe laryngismus with the tetany of young children, and its absence in that of adults, has already been noticed, and the solution of this curious fact would seem to lie in the above considerations.

The importance of the proper nourishment of the brain, of the hygienic surroundings of the individual and his exposure to fresh air, cannot be over-estimated during this period of evolution. A condition of mal-nutrition would affect not so much the already developed centres of the



“lowest level,” but must profoundly influence and tend to retard the developing higher functions, including those of inhibition. Hence would ensue an exaggeration of that “excitability,” which is the characteristic of even a healthy infant’s brain. If this be so, we should expect that in rickets, which is essentially a disease of mal-nutrition, the centres (being inadequately controlled) would be in a state of very unstable equilibrium, and that the frail barrier of restraint would break down under conditions which would be easily resisted by a healthy brain. The frequency of convulsive affections in rickety subjects shows that this indeed is the case. In many cases of severe rickets the development of the brain is evidently retarded—at times so much so that it may be extremely difficult to determine that the child is not really an idiot. In some of the slighter cases of rickets, however, a certain precocity in the evolution of some of the centres is noticeable, but their instability is generally equally apparent. This, I take it, depends on the development of the centres ahead of their checking arrangements to a greater degree than obtains in a healthy brain. In other words, I believe that the chief effect of rickets upon the infant’s brain consists not so much in retarding the development of the centres, as in diminishing their inhibition and therefore their powers of resistance.

It has been previously noticed that laryngismus is generally accompanied with an increased excitability of the motor nerves. What the exact significance of this is one cannot, at present, determine. It is inconceivable that such an inert tissue as the fibrous coverings of the nerves should develop an irritability communicable to the axis cylinders; besides, the substance of Schwann bars the way, and if this were rendered excitable, the transmission of impulses along the nerve would become incomplete or impossible on account of their diffusion. The increased irritability therefore must lie in the axis cylinders themselves. Since there is no morphological distinction between afferent and efferent nerve fibres, it is quite possible that the axis cylinders of the sensory nerves participate in the increased excitability of the motor. If this be so, it is evident that the reflex activity of



the individual is increased not only in extent but in degree, for the normal intensity of the afferent impulse will become exaggerated by the increased irritability of the sensory nerves, and hence a correspondingly more complete discharge of the centre will take place, for as Mercier<sup>1</sup> says, "a stronger shock will displace more atoms than a weaker shock; and since the greater number of atoms displaced, the more force is liberated, it follows that, other things being equal, the greater the disturbing force, the more powerful will be the resulting discharge." This effect will tend to be further increased by the greater instability of the out-going motor fibres, on account of which a lesser stimulus than normal is required to produce the same result. The same is no doubt also true of central impulses, the intensity of which, to produce a given result, would require to be in inverse proportion to the excitability of the motor outlets; or, otherwise expressed, it is necessary for the inhibitory arrangements of the centres to be the more complete, as the facility for the trajection of impulses to the periphery is the more pronounced, *i.e.*, in proportion to the degree of motor excitability. But reasons have been brought forward to show that the inhibition of developing centres is incomplete, and it has been suggested that the occurrence of rickets tends further to accentuate the deficiency. Many children have moreover a strongly marked neurotic predisposition, and this, with Clifford Allbutt,<sup>2</sup> I regard as merely a tendency to a congenital defect of inhibition. For these several reasons the brains of rickety children, especially those of a neurotic strain, are unstable—deficient in the power of resistance. This, however, may be quite sufficient for the proper regulation of the cerebral processes, provided only no great demand be made upon it, and the child be placed under favourable conditions of existence. If these necessities be not complied with, it is not surprising that a breakdown takes place, which may be only partial and limited, or complete, and resulting in general convulsions. It is clear that the evidence of this widespread defi-

<sup>1</sup> 'Nervous System and Mind,' p. 25.

<sup>2</sup> *Med. Times*, February 14th, 1885.



ciency of inhibition will be most apparent in those centres which are normally least fully controlled, and these have been already shown to be the respiratory, and especially their laryngeal element. Hence respiratory and laryngeal spasms, which occur even in healthy children from emotion, &c., will be intensified in proportion to the increased deficiency of inhibition, and reflex and other causes, which before were inadequate, will now be capable of inducing them. Such exaggerated spasms may now be called laryngismus.

According to the explanation of the pathology of laryngismus here suggested, it will be noticed that the disease merely consists of an augmentation of processes, which are so extremely common that they may almost be regarded as physiological. Whether this tendency to over-action of the centres depends on rickets, an inherited neurotic taint, or upon a deficiency of emotional control, the result is the same. Hence there is no essential difference between a fully-developed laryngismic paroxysm and the quasi-laryngismic attacks of a passionate, although otherwise healthy, child. The distinction between the two conditions would seem to lie in this: that in the former case the respiratory and laryngeal centres are constantly under such feeble control that many influences may at times be sufficient to break it down and set up a paroxysm; whereas in the latter case, these centres are sufficiently stable for ordinary working purposes, and their control only breaks down when subjected to the strain of violent emotion. Again, according to the present interpretation of laryngismus, it is evident that no one of the several factors that tend to its causation is absolutely necessary, and that the slightest cases, represented by an occasional crow, are of exactly the same origin and differ only in degree from those which have a fatal result.

In regard to the laryngeal spasm which accompanies swallowing, it will be remembered that a suggestion was made in a previous part of this paper that the vocal cords were normally adducted during this act. An impulse, therefore, from the cortical centre—representing the asso-



ciated act—would proceed to the œsophageal centre—one of the most stable in the whole nervous economy—and to the laryngeal—which has been shown to be just the reverse. The œsophageal element is therefore efficiently performed, but the laryngeal is “overdone” (if I may so express it); for the control of the centre, deficient from the first, has probably been still further weakened by frequent discharges, the result of emotion, and the simple contraction of the adductor muscles of the cord is replaced by a spasm. This, as far as my own experience goes, is always slight, as would be expected, and never attains the profound degree which may mark the laryngeal spasm arising from emotion. I have seen one case in which I suspected that the œsophageal centre was equally unstable with the laryngeal. The patient was under the care of Dr. Bristowe, who kindly allows me to mention the case. He was a boy of about four years old, who had occasional attacks of œsophagismus—one of which was so severe that he had to be fed for some time with nutrient enemata. No obvious obstruction could be detected by means of bougies, and at times he was perfectly well. He suffered severely from croup each winter, and had easily obtainable facial irritability when I saw him. It seemed to me that, for some reason or another, the centre for swallowing was equally, with the laryngeal, under deficient control, and that the action of the œsophageal muscles was “overdone” for a similar reason to that which has been previously suggested in regard to laryngeal spasm.

If the views here enunciated be correct, it is evident that the paroxysms primarily result, not from any increased excitability of the lowest level centres, but from a deficiency of their controlling arrangements, situated at a higher level. Dr. Jackson believes that the seat of the discharging centres is in the lowest level. This may possibly be the case, although it would seem more likely that these, being the first developed, would be more fully controlled, and therefore less unstable, than their developing cortical representatives, and Dr. Semon, writing to me on this subject, says that for several years he has thought and taught at St. Thomas's Hospital that laryngismus stridulus is a cortical



affection. It is possible that future experiments on the cortical localisation of the respiratory muscles will be of great assistance in helping to clear up this question.

*Diagnosis.*—The only real difficulty is experienced in cases of recurved epiglottis, which may closely simulate laryngismus. They are, however, congenital, and a certain amount of constant inspiratory stridor may be heard, if carefully listened for. They are not necessarily associated with rickets, and the presence or absence of facial irritability will be here of some service.

*Prognosis.*—Laryngismus is certainly not now the fatal disease it was once considered. The statistics of the older, and indeed some of the comparatively modern writers, would place the mortality at 50 per cent., but with such a terrible affection we have happily not now to deal, at any rate in this country. The prognosis is generally good, especially when it is possible to place the patient under proper hygienic conditions and the emotional tendency is not pronounced. A child who is subject to uncontrollable fits of passion may at any time die in a laryngismic paroxysm, as indeed happened in the case before narrated.

*Treatment.*—From what has gone before it is evident that the chief factor in the treatment of laryngismus consists in placing the patient under favourable conditions of existence. There must be no "coddling." The child must be fed on rational principles, and allowed to breathe pure air. If this cannot be obtained in a town, the patient should, when possible, be taken to live in the country, and permitted to respire as much fresh air as he can get. This alone, as I have frequently found, is attended with most excellent results. One case especially recurs to my mind of a female child, who was treated to no purpose for months with all the most approved pharmacopœial remedies, but whose opportunities of obtaining pure air were *nil*. The paroxysms were exceedingly severe, with carpo-pedal contractions and occasional convulsions. I advised her removal to the country, where she rapidly got quite well, although the laryngismic season was then at its height. When the affection is so severe that the slightest exposure to cold air brings on a paroxysm,



it becomes necessary to gradually educate the patient to be able to resist all kinds of weather. A commencement should be made with an occasional move from one room to another, then a venture may be made out of doors, when the day is sunny and free from wind, then colder days may be chosen and so on. A valuable accessory to this line of treatment consists of a morning bath, with a sort of spinal douche, at first of tepid water, subsequently rendered more cold. By means of both of these measures the child's capability of resisting external influences is vastly increased. Of the large number of vaunted specifics, there is really only one worthy the name—cod-liver oil. This is not only the best treatment for the rickets, so frequently present, but is, I believe, of the greatest possible value in assisting to "build up" the brain. I therefore prescribe it equally in all cases of laryngismus, without any reference to the intensity of the rickets. Chloral, bromide of potash or of ammonia may be given at night time, especially when there is spasmodic contraction of the muscles during sleep, or the nocturnal paroxysms of laryngismus are severe. If the case is complicated with tetany or convulsions, of course additional means of treatment will have to be adopted, but the question of the hygienic environment of the individual is still of the first importance.

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