

present in such large quantity as to lead to permanent damage before that period arrives, and its marks will be carried through life. Dr. Chatellier (*loc. cit.*) has called attention to the deformities of the bones of the head and face which result from neglected adenoid growths. He points out that the air-cavities, as the frontal, sphenoidal, and ethmoidal sinuses, and the antrum of Highmore, being normally in communication with the air, cease to develop when the circulation of air through the nose is interfered with, and hence the dimensions of the face are altered. The lower jaw, which follows its normal development, often protrudes over the upper jaw, which is contracted in front, the upper lip is drawn up, while the hard palate, from the constant atmospheric pressure within the mouth, is pushed upwards, terminating in a sharp angle, like the Gothic arch. It does not seem at all unlikely that the many cases of deafness in adults due to ankylosis of the ossicles, or other structural changes in the middle ear, and which are associated with the V-shaped palatine arch and contracted upper jaw, are the remains of these adenoid growths which accomplished their destructive work in early life undiscovered and unsuspected. The relation of this complaint to certain cases of deaf-mutism must be for future observation and experience to determine.

Dupuytren in his "*Mémoire sur la Dépression Latérale des Parois de la Poitrine*,"<sup>11</sup> says that no disease ever presented to him a more painful spectacle than that of an infant who had the parietes of the chest pressed in laterally, enlarged tonsils and violent whooping-cough. It experienced at each crisis of the cough such oppression that instant death seemed to be threatened; it died indeed in one of the paroxysms. That adenoid growths in the naso-pharynx were at fault in this instance, there can be but little question. Provided the naso-pharyngeal space be unobstructed, enlarged faucial tonsils cannot seriously interfere with inspiration, certainly not to the extent of producing the deformity of the chest walls described by the French writers already mentioned, also by Coulson,<sup>12</sup> of London, and by J. Mason Warren,<sup>13</sup> of Boston. The children seen by Dupuytren "suffering under depression of the sides of the chest and enlarged tonsils at the same time, and who fell, after violent but useless efforts to breathe and after cruel suffering, into the most alarming state of convulsion, or into a state of suffocation, amounting to asphyxia from which state they recovered only to fall again into the same danger at the end of a few minutes," were the victims of adenoid vegetations.

It is apparent that the ravages of scarlet fever, diphtheria and measles, are more severe in children if these growths happen to be present. The various reflex phenomena, also, which may take the form of a true chorea minor, as Dr. A. Jacobi<sup>14</sup> has observed, and for which the naso-pharyngeal cavity is responsible, should impress upon us the influence of this region upon the well-being of the child, and the importance of paying attention to it. Its most frequent affection in children is the one we have been here considering, and I can only repeat, what I said in my first paper on this subject, that there is no other disease in the domain of him who confines himself to the upper respi-

ratory tract, the treatment of which is attended with more satisfaction to the operator, or with more permanent relief to the patient. If the results in all children are not equally good, owing to more or less permanent damage before the removal of the growths, the operator has at least the gratification of restoring to the children a permeable air-tract.

## RELATION OF ADENOID GROWTHS IN THE NASO-PHARYNX TO THE PRODUCTION OF MIDDLE EAR DISEASE IN CHILDREN.<sup>1</sup>

BY CLARENCE J. BLAKE, M.D.

THE subject of adenoid growths in the naso-pharynx and their effect upon the organ of hearing has been so well treated by Meyer,<sup>2</sup> Loewenberg,<sup>3</sup> and others, that the present paper must, in justice to these acute observers, be regarded rather as a recapitulation, the motive for which is that, in view of the large number of cases of this class among children, attention cannot be too widely drawn to a cause of aural disease often unrecognized, and when once found easily removable.

The fact that the artist Catlin<sup>4</sup> was led to classify and contrast the so-called mouth-breathers among whites with the nose-breathing American Indians among whom he lived and sketched for many years, is sufficient evidence of the recognizable existence of such a class in our community, although the local cause of what he stigmatizes as a vicious habit was not appreciated by him, or indeed by any physician even, so far as we have record, until Czermak signalized the invention of his method of rhinoscopy by the discovery of these glandular tumors.

That Catlin's artistic eye should have been offended by the distortion of the human face which he so graphically portrays is to be expected, but he also mentions impairment of hearing among the accompaniments of the "bad habit of mouth-breathing."

Since the organ of hearing is the channel through which, pre-eminently, in childhood the stimulus to mental development comes from the outer world, a fact of which we have ample evidence in the results both of physiological experiment and clinical experience, and since the enlargement of Luschka's glands is a disease of childhood particularly, though its consequences may continue through adult life, a recognition of the relation which this disease bears to the hearing power is of great importance.

The presence of adenoid growths in the naso-pharynx affects the organ of hearing and its function mainly in two ways—by interference with the ventilation and with the blood-supply of the middle ear. To clearly review the manner of this interference it is well to consider the means provided for continuing a definite supply of air in the middle ear, and for maintaining a just balance of the arterial and venous circulation in that part of the organ of hearing which suffers most immediately from the filling of the naso-pharyngeal cavity and consequent closure of the Eustachian tube. This passage, the Eustachian tube, which is both drain and ventilating shaft, is in the

<sup>11</sup> *Répertoire Général d'Anatomie et de Physiologie*. 1828, p. 110.

<sup>12</sup> *Deformities of the Chest*. 1837.

<sup>13</sup> Enlargement of the Tonsils attended by certain Deformities of the Chest. *Medical Examiner*, May 18, 1839, p. 309.

<sup>14</sup> *The American Journal of the Medical Sciences*. April, 1886.

<sup>1</sup> Read before the Boston Society for Medical Observation, February 6, 1888.

<sup>2</sup> W. Meyer. Ueber adenoid Wucherungen in der Nase und im Rachen. *Arch. f. Ohrenheilk.* 1873-74.

<sup>3</sup> B. Loewenberg. Les tumeurs adénoïdes du pharynx-nasal. Paris, 1879.

<sup>4</sup> Catlin. *The Breath of Life*.

child both shorter and wider than in the adult. its tympanic orifice is comparatively large, but the pharyngeal orifice is indicated only by a slight depression or fissure in the lateral pharyngeal wall, and the posterior prominent portion of the tube which forms a decided projection in the adult is hardly noticeable.<sup>5</sup> The former of these anatomical conditions, as is evident, favors rapid recuperation after restoration of patency of the Eustachian tube, and the latter renders that passage much more easily occluded at its faucial end by the pressure of any substance filling the naso-pharynx. The constant permeability of the upper portion of the Eustachian tube has long been a question actively and ably discussed on both sides for and against, but the weight of evidence is now in favor of the view that the Eustachian tube is not a constantly open ventilating shaft for renewal of the air in the middle ear. As the air in the middle ear is being absorbed constantly, with greater or less rapidity according to the state of the circulation in the mucous membrane, its renewal must be provided for by gaseous interchange,<sup>6</sup> or by the operation of such mechanism as shall, by opening the Eustachian tube, and at the same time causing increased atmospheric pressure in the naso-pharynx, assure the ventilation beyond peradventure.

This process, in which the acts of deglutition and of phonation play an important part, is provided for through the operation of two muscles, the levator and tensor palati molles, both of which are double-action muscles, being attached at the one end to the soft palate, and at the other to the anterior and inferior walls of the Eustachian tube. Each voluntary movement of the soft palate, therefore, is accompanied by the contraction of the palatal ends of these two muscles, and by a corresponding movement at the tubal ends, the result being a withdrawal of the anterior from the posterior wall of the Eustachian tube, and at the same time a depression of the inferior wall or floor of that passage giving it a greater inclination downward toward the pharynx. The same movement which opens the Eustachian tube, by lifting the soft palate, tends to compress the air in the naso-pharynx, and so favors still further the ventilation of the middle ear.

The same simultaneity of action, and the same effect in a lesser degree, is found in phonation. In the production of all the consonant sounds, with exception perhaps of the sibilants, there is more or less back pressure, pneumatic pressure in the pharynx and naso-pharynx, while with all the back consonants so-called, *k. g.* for instance, there is in addition a very strong and decided muscular contraction of the soft palate, as shown by the very interesting tracings made with the palate myograph,<sup>7</sup> and in the use of the glosso-graph of Amadeo Gentilli. Control experiments made by the writer in cases of perforation of the membrana tympani by means of manometres placed in the ear, and in cases of manometric cicatrices of the membrana tympani by direct observation of the movements of the cicatrices show that there is a decided increase of air pressure in the middle ear coincidently with the pronunciation of the consonant sounds, and most markedly with *m n ng* and the back conson-

ants, while the forcible expulsion of air and the elevation of the soft palate in crying produces movements of the manometric cicatrices which show that this operation tends also to assist materially in the process of ventilation of the middle ear. In addition to these more active provisions for this purpose, namely swallowing, speaking, crying, and the numerous co-ordinate muscular movements of the throat, there are the passive movements of the soft palate and the changes of air pressure in the middle ear, which occur during sleep with each respiration.

With the presence of a growth in the naso-pharynx this admirably working mechanism is interfered with, and even if the growth is not sufficiently large to occlude the faucial orifices of the Eustachian tubes, it interferes with the palatal movements, and with the proper balance of air pressure in the naso-pharynx, and is inevitably productive of injury to the ear, the result of the decreased air pressure being the production of a partial vacuum in the middle ear, with its consequent train of congestion, swelling of the mucous membrane, and trophic changes of greater or less permanency according to the duration of the abnormal condition. That it is not necessary that the growth should be a large one to influence the ear is shown by the effect which a small growth has upon the pronunciation of all the nasal consonants; that is to say, upon the palatal movement. Where the growth is large and exerts considerable pressure on the walls of the naso-pharynx, there is in addition to the consequences already mentioned an effect directly upon the blood-supply of the Eustachian tube and middle ear by interference with the return of the blood from the middle ear through the tubal into the lateral pharyngeal veins.

A portion of the blood-supply to the anterior and superior portions of the tympanic cavity and to the membrana tympani comes through a small artery running along the upper walls of the Eustachian tube, the blood so supplied being returned in part through veins running superficially downward in the tubal mucous membrane. Mechanical pressure on the lateral pharyngeal wall, in the neighborhood of the Eustachian orifice may therefore result in a blood stasis in the middle ear, and in an objective condition similar to that admirably described by Boucheron, as seen by him in certain cases of so-called deaf-mutism in children whom he relieved by catheterization of the Eustachian tube. The description by Boucheron of a membrana tympani, dull, greatly depressed, and of the deep blue-red color indicating venous congestion of the middle ear, appearances markedly seen in some of the cases which suggested this paper, permits the supposition that in some of his cases, also, he had to deal with the results of adenoid growths in the naso-pharynx.

The train of aural symptoms which come from the presence of adenoids are, therefore, such as would result from interference with the normal ventilation and nutrition of the middle ear tract, and are more or less permanent, according to the duration and size of the adenoid growths.

In the earlier stages, when the growth is small, the ear is noticeably affected only when, in addition to the bulk of the growth in the naso-pharynx, there is added the encroachment upon the space of that cavity by swelling of the mucous membrane, accompanying so-called head-colds. As the growth increases less

<sup>5</sup> Politzer. Lehrbuch der Ohrenheilkunde.

<sup>6</sup> Loewenberg. De l'échange des gaz dans la caisse du tympan. Progr. Méd., Feb., 1887.

<sup>7</sup> A new method of studying the motions of the soft palate, Dr. Harrison Allen. Phila., 1884.

and less swelling effects the deleterious purpose, and the intervals of freedom from impaired hearing, nocturnal ear-ache, and subjective noises in the ears become shorter and more rare. In the meantime changes are taking place in the structures of the middle ear which are more or less permanent; the preponderating pressure on the outer surface of the membrana tympani pressing that membrane inward, and allowing the relaxed tendon of the musculus tensor tympani to contract and hold the malleus, and with it the membrana tympani, in its abnormal position, tends, as does also the thickening of the mucous membrane, to permanently impair the mobility of the sound-transmitting mechanism of the middle ear, or, as is seen in some cases, the impairment of nutrition, lowering the vitality of the delicate tissues in the middle ear, an ulcerative and suppurative process is easily set up under the necessary additional provocation.

In some of the cases mutually observed by Dr. Hooper and myself there was suppurative inflammation of the middle ear, which first showed any gratifying response to local treatment only after the removal of the adenoid growths.

In reference to the aural symptoms, the cases under consideration may be divided into three classes. The first includes those in the earlier stages of the adenoid growths, which have had occasional ear-ache and the occasional impairment of hearing apparently readily referable only to what is called a head-cold. These children have very variable hearing, are frequently accused of inattention and disobedience, and are either too young to know, or have too slightly noticeable an impairment of hearing to appreciate that their derelictions are sins of the flesh and not of the spirit. The effects to the ear of the removal of the growth in the naso-pharynx are often appreciable only to the trained observer; the child is freed from a catarrhal affection, and the improvement in hearing, if any is noticed, is taken for what it is, a matter of course. An objective examination of the ears, however, shows that there is no longer a slightly congested condition of the tympanic mucous membrane, and in the course of time the thickening of the mucous coat of the membrana tympani is seen to be decreasing. In the second class are the more advanced cases, in which, the preliminary stages being passed, the impairment of hearing and the structural changes have become recognized as fixed facts, the impairment of hearing in some of these cases being so great and so persistent that the child is regarded either as a deaf-mute, or even as idiotic, the well-known effect of obstruction of the hearing upon the mental development favoring the latter supposition. In many of these cases it has been found that catheterization of the Eustachian tubes, the air douche proving ineffectual on account of the blocking of the Eustachian orifices and interference with the movement of the palate by the growth, has decidedly and immediately improved the hearing, and entirely changed the objective symptoms in the ear, the membrana tympani, previously dull both in color and in lustre, returning to the normal appearance in a greater or less degree in both respects.

The improvement in both appearance of the ear and in hearing power in these cases, consequent upon the use of the Eustachian catheter, is, however, but temporary, the true cause of the abnormal condition remaining.

In by far the largest majority of such cases the removal of the adenoid growths is followed by an immediate and gratifying improvement in hearing, which in some of them remains unabated. In others, however, the impairment is again noticeable at the end of a few days. In all of these latter cases there is accompanying, and as a result of the adenoid, a considerable swelling and congestion of the naso-pharyngeal and tubal mucous membrane, enough in itself to interfere materially with the physiological action of the Eustachian tubes. The free bleeding following the operation upon the adenoids sufficiently depletes the swollen mucous membrane to bring about a condition of freedom for the middle ear temporarily, which is permanently attained subsequently only by patiently continued treatment.

To the third class belong those cases, already alluded to, in which suppurative otitis media is a result of the disease in the naso-pharynx plus some local exciting cause, or is merely a coincident of a suppurative disease of the middle ear of other origin. That the maintenance of patency of the Eustachian tube is an important factor in the successful treatment of these cases is well recognized, and in at least two of the cases which are the subject of this joint memoir, the effect of the removal of the adenoids upon the response of the ear to the same treatment which had been previously pursued was most gratifying.

A classification of the cases mutually observed and operated on under ether by Dr. Hooper, which are the only ones here included, shows that out of the whole number, thirty-nine, or nearly eighty-three per cent., had evidence of more or less implication of the ear, and that of that number in thirty-five, or nearly ninety per cent., the result as evidenced by the improvement in hearing was eminently satisfactory.

Comment upon the importance of a recognition of these cases, and the application of an early remedy, is, in view of these and similar results of other observers, and of the known consequences to the hearing in later life, of the persistence of these abnormal conditions, quite unnecessary. It is well to bear in mind, however, that with the removal of the adenoid growths the work—as regards the ear—is not entirely done, and that the rhinologist and otologist must act as friends in council; the removal of the cause is the first step, it is true, but, though as Dr. Holmes says—and this seems especially true of children—"Nature is kinder than the doctors think," some assistance is needed in many of these cases to help on the removal of the consequence of the cause.

## NOCTURNAL INCONTINENCE OF URINE.<sup>1</sup>

BY E. M. BUCKINGHAM, M.D.,  
*Instructor in Diseases of Children, Boston Polyclinic.*

THE subject of nocturnal incontinence of urine in children is of interest both from the obscurity that sometimes surrounds its etiology, and from the great annoyance to which it subjects the patient and his friends. It is a symptom, and, like many other symptoms, does not always depend on one and the same cause.

Aside from cases depending upon deformity, upon

<sup>1</sup> Read before the Boston Society for Medical Observation, February 6, 1888.