

603 | CONCANON (J. J.) | 603

Abnormal Respiration in Infants
From Obstruction in the
Upper Air Passage

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ABNORMAL RESPIRATION IN INFANTS FROM OBSTRUCTION IN THE UPPER AIR PASSAGE.

BY JAMES J. CONCANON, M.D.

Normal infantile respiration in sleep is quiet, noiseless, save for the soft low inspiratory murmur, always nasal, chiefly diaphragmatic. During the first month its rhythm is irregular, there are frequent pauses and at times it is deeper, as in the Cheyne-Stokes variety. Its rate varies from 30 to 45. At the end of the third year it is regular and has a rate of 24. The rhythm is changed by very slight impressions. The movements seen are the ample ones of the abdomen, the lesser ones of the thorax and those of the nasal alæ. There is no drawing in of the fleshy portions of the thorax, the mouth is closed and the act of nursing can be completed without interruption.

Widely differing in its symptoms from that due to pulmonary or bronchial affections, abnormal respiration from obstructions in the upper air tracts is more difficult to trace to its cause, but is more amenable to treatment. Many fatal cases have shown that errors of diagnosis are common. Only recently has it become generally known that nearly all cases of croup are true diphtheria. Deaths from foreign bodies in the larynx or trachea, or from growths therein, could have been prevented had these not been mistaken for croup.

There exists hardly any other affection so dangerous and distressing to the patient, alarming to his family, or trying to the physician as obstructive dyspnea; nor

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603-

is there any in which treatment is more effective. In no other condition is the skill of the surgeon or the ability of the physician so evident. Antitoxin is the greatest medical triumph of the nineteenth century, and intubation and the recognition and removal of obstructive growths are amongst the most brilliant of surgical achievements. Occuring with great frequency in early childhood, respiratory obstruction may be regarded as one of the most important of pediatric subjects. The condition may last for moments or for years; life may be ended by it in a few moments or made unenjoyable for months or throughout its whole duration.

The symptoms, effects and treatment vary according to the nature and degree of the obstruction, and with its situation, which may be in the nasopharyngeal, the pharyngeal, or the laryngotracheal portion of the air tract. The first of these divisions extends from the anterior nares to and including the retronasal space; the second, from the level of the palate to that of the larynx; the third, from the mouth of the larynx to the lower end of the trachea. Briefly, impediments in the nasopharyngeal portion cause mouth-breathing; in the pharyngeal, snoring, and in the laryngeal stridulous respiration.

Of the three, that last mentioned is by far the most important.

LARYNGEAL OBSTRUCTION.

Laryngeal obstruction figures largely in infantile mortality. Phonation being one of the principal functions of the larynx, an altered or lost voice will be one of the earliest symptoms of obstruction.

The larynx being also the gateway of the respiratory regions, its partial closure interfering with the influx of air soon causes dyspnea with laboring inspiratory movements and noisy breathing.

Causes and symptoms.—The causes of laryngeal dyspnea in infants are numerous. Dividing them into six groups, it will be convenient to study, first, their

nature and symptoms, and afterward their diagnosis and treatment.

Malformations of the larynx may cause congenital aphonia, hoarseness or dyspnea. There have been found membranous webs joining the vocal chords, and elongations of the arytenoid cartilages, preventing proper closure of the glottis and giving rise to whispering voice. The epiglottis in infants is folded longitudinally, approximating the aryteno-epiglottic folds. In some cases this causes so much narrowing of the entrance to the larynx, as to give rise to what has been called chronic infantile stridor, which is accompanied by crowing inspiration that at times becomes shriller as the dyspnea increases and again subsides to the low-pitched stridor which is always present even in sleep. One case of this affection has been under the author's observation since birth. Although there is a great improvement, noisy inspiration with occasional attacks of dyspnea exist still, the child being 3 years old. Even slight congestion may be very dangerous in these cases.

Laryngeal growths are nearly always papillomatous in infancy, fibroma being rare and myxoma and cysts rarer still. The last named are sometimes found on the epiglottis. Growths give rise to dys- or aphonia, cough and dyspnea. The number and intensity of the symptoms depend upon the size, situation and character of the tumor. Granulations from tracheotomy wounds may be a cause of obstruction. With pedunculated subglottic growths the symptoms may be intermittent. Systemic effects, anemia and failure of development from imperfect respiration are present in proportion to the duration of the obstruction.

Foreign bodies according to their nature, size and location, give symptoms varying from the mere sense of their presence to the most distressing dyspnea or instant death. In infants they nearly always cause dangerous stenosis, although in out-of-the-way places they may be present for a long time without giving rise to any pronounced symptoms, but may at any

time cause fatal obstruction from edema or displacement. Pointed bodies, pins and fish-bones, and prickly ones, as sand-burs, usually fasten themselves in the larynx. Fish-bones may be fastened across the glottis without serious symptoms unless edema occurs. Pieces of meat or other food, vomited or swallowed, entering the larynx are perhaps the most dangerous and frequent of foreign bodies ordinarily met with in infants. Smooth, roundish bodies, such as small glass beads, buttons and fruit stones may pass into the trachea. Bronchial glands have also been found therein. If these do not pass into the bronchi they may remain loose in the trachea, a source of great danger from being subsequently wedged into the glottis.

Inflammations of the larynx, idiopathic or caused by the exanthemata, malaria, aphthæ, erysipelas, pertussis, typhoid, influenza, syphilis, tuberculosis, urticaria, erythemanodosum, pemphigus, traumatism, cold, inhalation of steam or of caustics and foreign bodies cause edematous, membranous, spasmodic or cicatricial stenosis.

Cicatrices are the result of congenital syphilis, sometimes of inhaled steam or caustics. Stenosing infiltration is extensive in syphilis, burns and tuberculosis. Spasmodic stenosis may result from congestion or inflammation, the local condition acting as an irritant to excite closure of the glottis.

Membranous exudates occur not only in diphtheria but also with scarlet fever, influenza and aphthæ.

Stenosis depending upon causes that act through the laryngeal nerves are frequent in infancy, at which period the controlling centers are undeveloped and motor response to all irritations is very active. Apart from the spasm occurring with congestion or inflammation of the larynx, reflex spasm may be due to dentition with its slight cough, pertussis with its inspiratory dyspnea, or to tetany or rickets, which are not seldom fatal. Other reflex causes are mediastinal tubercular glands, retro-esophageal abscesses, or hyper-

trophied thymus gland pressing upon the recurrent laryngeal nerve. Others yet are foreign bodies in the ear, nose or tonsils. Adenoid growth of the nasopharynx and elongated uvula are not infrequent causes. In some cases of rickets these spasmodic attacks of dyspnea are easily excited. One case happened in the author's practice where tetany and laryngismus stridulus coexisted. An attack fatal in half a minute, was caused by feeling the pulse. In chorea the inspiration has a peculiar wavy character which may be due in part to the intermittent contractions of the laryngeal muscles. Paralysis of the larynx often follows diphtheria and may be a cause of severe continuous dyspnea. Unilateral abductor paralysis gives dyspnea upon exertion only. It may result from compression of the recurrent laryngeal nerve. Suffocation from particles of food is likely to happen.

The pressure upon the larynx or trachea of retroesophageal abscesses, enlarged cervical glands, hypertrophied thymus gland or foreign bodies in the esophagus may be causes of fatal dyspnea, as may also the peritracheo-laryngeal abscesses described by Massei.

Diagnosis.—Notwithstanding that the diagnosis of some of these laryngeal causes of dyspnea is often a matter requiring no small degree of ability, it would be more often successful if it were generally known that the examination of the larynx in infants is not at all so difficult as has been believed. It is not, as in the case of adults, a matter of training the patient, but one of gentle force, properly applied. Probably not one physician in fifty examines the infant larynx. Direct and laryngoscopic examination of the larynx should be practiced until skill is acquired. No one can be considered an adept in the treatment of diseases of childhood who is not proficient in the employment of modern methods for the diagnosis and treatment of the diseases and abnormalities of the upper air-passages. No careful physician commences the treatment of an infant without examination of at least the

fauces. In three-fourths of the cases, as we get them, the upper air-passages are involved. With the patients head well back and the tongue drawn forward, by means of the little finger placed beside the epiglottis, or better yet, with the spatula of Escat, the knobbed forks of which fit into the sinus pyriformis, the larynx can be opened to laryngoscopic and, in many cases, to direct examination.

In the diagnosis and treatment of the first three classes of causes of stenosis, malformations, tumors, and foreign bodies, laryngoscopy is indispensable. Acute stenoses have diverse causes but symptoms much alike. Moreover, the history is often obscure. While unobserved the infant may have swallowed a pin or button, or inhaled steam from the spout of a kettle and can not or will not give an account of it, hence, examination of the larynx is necessary for intelligent treatment. Bodies in the trachea may give symptoms easily mistaken for those of croup. The laryngoscope will often fail here and then recourse must be had to the Roentgen rays, which method, cryptolaryngoscopy, has been successfully used for the location of foreign bodies in the air tracts and esophagus.

Inflammatory conditions are distinguished from others by the presence of fever, the symptoms of the causative disease or the history of the causative accident. It is well to remember that with stenosis occurring in the course of acute diseases, the Klebs-Loeffler bacillus can often be found. In very severe stenosis occurring in the course of measles or scarlet fever, it is much better to administer antitoxin at once, which will often serve not only to cure but in so doing will indicate the true cause while awaiting further confirmation of the bacteriologic examination. Stenosis from inhalations of steam or other irritants can be ascertained by examination of the fauces and epiglottis, where their action is quickly manifested, urgent dyspnea and dysphagia coming on rapidly as the result of extensive swelling.

Spasmodic dyspnea is most frequently found in connection with rickets, of which disease laryngismus stridulus is but a symptom, whose presence makes the diagnosis easy. Absence of fever and transitory character point to the affections being functional. The various reflex causes already mentioned should be sought out.

The causes of compression should be remembered. When present they are, as a rule, easily found. Abscesses may at first be difficult to discover. In obstruction, for bronchial dyspnea may closely simulate laryngeal or tracheal dyspnea. The laryngoscope, X-rays, auscultation and percussion may be necessary.

Treatment.—In dealing with laryngeal and tracheal obstruction there are four agents that must often be used—used with a skill that all should try to acquire, namely, the antitoxin syringe, the O'Dwyer tubes, the laryngeal forceps and the knife. Intubation, tracheotomy and, certainly the use of forceps for the extraction of foreign bodies and the removal of growths should be first practiced on the cadaver. Malformations, tumors and foreign bodies, while considered to belong to the domain of laryngology, often give rise to a dyspnea that brooks no delay, and with which the physician who is called in the urgency of the case must be prepared to deal.

Congenital glottic webs are divided by means of the laryngeal knife. The stridor due to the peculiar infantile shape of the epiglottis generally disappears at the third or fourth year.

Tumors are usually removed by evulsion or crushing, with the aid of the laryngoscope and local anesthesia. Tracheotomy may precede or accompany these measures. Laryngotomy is employed only as a last resort, but may be necessary in young infants where death from suffocation is imminent. Intubation may in some cases be employed for temporary relief.

Foreign bodies, if they can not be removed by means of the laryngeal forceps and mirror, may require tracheotomy, and usually do in infants; the high operation for bodies in the larynx and the low one for those in the primary bronchi. The administrations of emetics and the reversal of the patient's body, as formerly practiced are dangerous, for if the foreign body be in the trachea, it may become wedged in the glottis. Inflammations may render necessary scarification, intubation or tracheotomy. They are best treated by applications of ice from the beginning. Derivatives and antispasmodics may be required to check accompanying spasm. The best remedy is probably codein, of which one milligram may be given at a dose to a child one year old, or morphin one-third of a milligram. Congenital syphilis requires mercurial inunctions and the internal administration of syrup of iodid of iron. When in the course of any of the acute diseases mentioned, a progressive, urgent dyspnea, accompanied by anemia and asthenia arises, it is best, as before remarked, to administer antitoxin at once, for nearly all such cases will prove to be due to the presence of the Loeffler bacillus. Prompt use of the serum will arrest the stenosis and render intubation unnecessary. Often, however, that operation will be required, not only in membranous but also in edematous, spasmodic and cicatricial stenosis. The tubes can be retained for long periods, a week or more without injury, those of hard rubber are best for long retention. Tracheotomy is not often required. For the relief of aphthous stenosis, Massei considers the ordinary catheter the best instrument. It can be used often and for brief periods to relieve the stenosis and detach the masses of *oidium albicans*. This instrument is invaluable for any form of dyspnea where the O'Dwyer tubes are not at hand. Cicatricial stenosis may render necessary repeated dilatation, prolonged retention of tubes or tracheotomy.

Aside from the treatment of the predisposing systemic condition, spasmodic stenosis is relieved by

chloroform, codein, chloral, bromids and other anti-spasmodics and by the removal of adenoids and other excitants. Intubation or catheterization will sometimes be indispensable.

Pressure stenoses are treated by removal of enlarged glands, evacuation of abscess, and sometimes intubation or tracheotomy.

PHARYNGEAL OBSTRUCTION.

In the pharyngeal region hypertrophied tonsils, peritonsillar abscesses, retropharyngeal abscesses, elongated uvulæ, cicatricial contraction and the presence of foreign bodies, are causes.

Hypertrophied tonsils, although often congenital, rarely gives much trouble before the second year. They cause snoring, imperfect articulation, dysphagia and offensive breath. Often concurrent adenoids add their symptoms. If the tonsils nearly meet they should be excised; if they project but slightly, they should be let alone. Peritonsillar abscesses should be opened just outside the upper edge of the tonsil. Foreign bodies are to be carefully sought for and removed. The epiglottis has been found fastened down by pins and fish-bones. Cicatricial stenosis from syphilis sometimes occurs in infancy. The soft palate may become adherent to the pharynx, so as to completely shut off the nasopharyngeal tract. Operation is not then very successful. Elongated uvulæ may cause reflex cough and need removal. The palatopharyngeal space may be so narrow as to impede respiration.

The one very important and often fatal obstruction met with in this region is retropharyngeal abscess from suppurating lymph nodes or vertebral caries. This disease belongs to infancy, three-fourths of the cases occurring in the first year. Influenza is perhaps the most frequent cause. Sometimes it follows scarlet fever. The symptoms are fever, prostration, dyspnea, pain, dysphagia, aphonia or dysphonia, the cry being of a peculiar guttural character. Inspiration is accom-

panied by a very characteristic snoring sound which attracts the attention of the examiner, to whom the fauces and pharynx appear normal where the abscess is low. The abscess, although bulging most frequently directly behind the mouth, may be hidden above the palate, latterly by the faucial pillars or below, opposite the larynx. In all cases of infantile dyspnea where the diagnosis is not clear, the pharynx should be explored with the finger. Called once to intubate a nearly suffocated child, considered by two physicians in charge to have laryngeal stenosis, the author found a large abscess at the level of the larynx. Incision gave prompt and permanent relief. These are often dangerous cases. Death has occurred from the slight increase of obstruction due to the insertion of a mouth gag preliminary to operation. If not found and evacuated, the abscess may kill by eroding large blood vessels or by bursting into the larynx. Starvation and dyspnea usually kill. In scrofulous children the abscess may refill many times. In such cases general hygienic treatment and the administration of small doses of calomel for long periods has given the best results.

The abscesses of Pott's disease are of rather rare occurrence and long duration. They surely refill. Occasionally they can be opened externally and should be.

NASAL OBSTRUCTION.

Passing now to the study of abnormal respiration from obstruction in the nasal and retronasal spaces, we find effects and symptoms of another order. Not from interference with the free entrance of air to the lungs does the patient suffer, but because of interference with the passage of air through organs designed for purifying; warming and moistening it preparatory to its reception by the delicate organs through which it is assimilated; for such is the function of the mucous membrane of the nasal chambers, whose superior half, moreover, depends upon the air current for the stimuli of the myriad olfactory impressions

conveyed by its nerves and so necessary to mental development and the enjoyment of life. Just as the digestive organs prepare food for absorption do the nasal passages prepare air.

Since the free passage of air is necessary for maintaining an equal atmospheric pressure on both sides of the tympanic membrane, impeded nasal respiration must cause imperfect hearing.

Again, the nasal chambers and antra modify the phonatory vibrations that pass through them. Their obstruction therefore renders imperfect vocalization inevitable. Not only is mouth breathing present and audition, olfaction, articulation, respiration, and consequently growth and development of mind and body seriously impaired, but the lungs, ears and eyes are rendered prone to catarrhal inflammations. Anemia is almost constant.

The effects of nasal obstructions are now becoming generally recognized. No one now doubts that the early relief of this condition enables a stunted backward child to grow and develop marvelously, reaching a perfection impossible without it. Indeed, the recognition and treatment of this condition should be a national care, for it means higher racial development. All familiar with the extraordinary improvement in a child after the removal of adenoid growths, will readily admit this. The peculiar physiognomy of some backward races, the Esquimaux for instance, is believed to be due to the presence of these last-named growths during childhood.

Causes.—Apart from malformations, the most important of which are absence of the septum and floor of the nose, which render respiration abnormal, and imperforate or extremely narrow nostrils, any of the following causes of obstruction may be congenital: Complete or partial occlusion from exostosis, ecchondrosis and deviations of the septum, hypertrophy of the turbinated bodies, bony cysts of the middle turbinated, polyps, abscesses of the septum. Frequent causes are, foreign bodies, fractures, diphtheritic membranes,

syphilitic lesions and what is not at all rare, and yet has received little or no mention so far as the author knows, in the literature of the subject, collapse of the *alæ nasi*. The acute inflammations are but transient.

In the nasopharynx is found by far the most frequent and important cause of nasal obstruction in infants, the so-called adenoid growths. Although often present in the new-born, it is toward the end of the first year that they are generally found. They are idiopathic or the result of acute infectious inflammations, especially influenza, a disease which few children escape during its prevalence.

Symptoms.—An infant having nasal obstruction from any cause presents an expressionless face, with open mouth and flabby folds, stretching down from the *alæ* of the generally flattened and running nose. This has been called the veiled face of adenoids. Deafness, otitis, mutism, anemia and eye affections are often present. The voice has a dead, nasal character, that of cold in the head. Snoring, restlessness, night terrors, inability to nurse are always present in cases of large growths. Postnasal, laryngeal, bronchial, aural and conjunctival catarrh are frequent accompaniments. Not only is nasal obstruction often the reflex of very distant irritants, but it may be the cause of apparently widely separated affections, such an enuresis. Fits of crying and continued frowning indicate headache. The mouth-breathing infant is generally anemic, puny, ill-developed and frequently affected by diathetic diseases. The rachitic are frequently mouth breathers; while predisposing to other diseases, the presence of nasal obstruction causes infants ill from any cause to do badly. An interesting case was recently reported in the *New York Medical Journal* of a child which having complete nasal obstruction from birth, with inability to nurse, died when one week old. At the autopsy the turbinated bodies were found congested to such an extent as to cause complete occlusion. Surgical treatment had not been attempted.

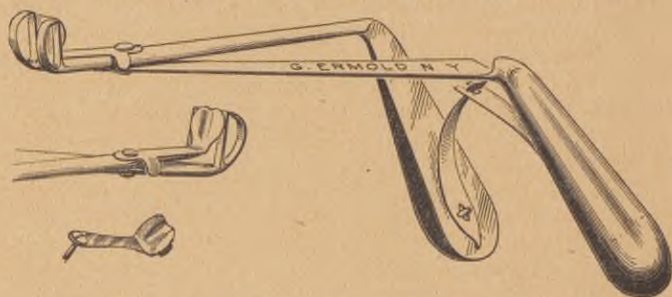
Diagnosis.—The first diagnostic procedure should be an examination of the nasopharynx; for adenoid growth will be found in four-fifths of the infants with chronic nasal obstruction. In a few seconds the physician's index or little finger slipped behind the palate, over the vomer and down the posterior pharyngeal surface, will not only have met the soft, pendant, easily bleeding masses, blocking the posterior nares, but will be found blood stained when withdrawn. In infants under six months, such examination being impossible, an applicator armed with a cotton nob introduced behind the palate or through the nose, touching the masses ever so gently, causes them to bleed, showing their presence. Anterior rhinoscopy requires some practice before a reliable diagnosis can be made of the obstructions in the nasal chambers. A novice in rhinology is most likely to fail in even so simple a matter as distinguishing a red fleshy hypertrophy of the inferior turbinated body from the gray oyster-like polyp of the middle turbinated. Nor can he easily determine whether it be a growth or a deflection that affects the septum.

Intranasal obstructions are, however, comparatively rare in infants. Abscesses of the septum have been found five times in the author's practice. It is easily recognized by the bilateral bulging of the septum. The probe detects bony or cartilaginous growths that completely or partly occlude. Collapse of alæ should always be thought of before a speculum is introduced. Unilateral occlusion with purulent discharge often means the presence of a foreign body, such as a shoe button or grain of corn. In diphtheria the anterior nares are usually excoriated and covered with a gray pellicle. The Loeffler bacillus is always present. The membranes may be confined to the posterior part of the nose and retronasal space.

Treatment.—Apart from the finding and removal of the reflex and other causes, when general treatment fails, hypertrophy of the turbinated bodies are reduced by the galvanocautery or snare; exostosis and ecchon-

droses are drilled through with the electric trephine. Bone cysts and polyps are snared away, abscesses opened and foreign bodies removed by means of forceps or hooks. Syphilitic lesions require mercurial inunctions and thorough cleansing. Nasal diphtheria demands prompt injection with antitoxin, in large doses and repeated until the membranes cease to recur. This form of the disease indicates not only its virulence, but that the patient is non-resistant. When collapse of the alæ exists it is treated by means of springs or frames that maintain the form and size of the nostril.

Practically, however, the treatment of nasal obstruction in infants means removal of retronasal adenoid



growths. The operation requires but a few seconds of time and no anesthetic. Cutting forceps and Gottstein curettes are employed. For growths on the posterior wall of the retronasal space the latter is the best. The forceps better reach the high growths which hang into the posterior nares and cause most of the obstruction. To prevent the injuries to the vomer, uvula and Eustachian tubes, which often occur with inexpert operators, and to guide the instrument into proper position for effective work, the author has devised a plate of peculiar shape which fits over the open jaws of the forceps and, when introduced, over the posterior edge of the vomer, also enables the operator to bring all the growths within the blades. This instrument accomplishes the operation at one applica-

cation. Only when there are extensive posterior growths a single sweep of the curette may supplement the forceps. The latter instrument has the advantage that the growths are always brought away with it, while with the curette they are usually swallowed. Hemorrhage nearly always ceases in a few moments. Three fatal cases have been reported. To check it, pledgets of cotton, saturated with solution of acetate of aluminum, should be drawn up into the nasopharynx by means of cords passed through the nose, and tied over the columella. Salt water irrigation, thrice daily for two or three days, is the only after treatment. Over two hundred cases have been treated in this way in dispensary practice with no evil effects whatever. The operation is invariably successful.

Rachitis, rhinitis, chorea, reflex cough, eye troubles, deafness, malnutrition, laryngismus, laryngitis, enuresis, night terrors and aprosexia will often resist the most careful treatment until the accompanying adenoids are removed, when convalescence will be rapidly established.

Having thus briefly dealt with the important subject of dyspnea in children under three years of age, it may be permissible to emphasize: The importance of laryngology in pediatrics; the facility with which the larynx may be examined even in infants; the necessity for ascertaining the condition of the upper air passages in all children, and for the removal of obstructive adenoid growths; the many causes of nasal and laryngeal dyspnea in infants, amongst which drawing in of the nasal alæ, sprue, inhaled irritants and foreign bodies are often overlooked; the frequency of retropharyngeal abscesses, necessitating digital exploration of the pharynx; that the bacillus of Loeffler is often the cause of laryngeal stenosis in acute diseases, and demands prompt use of antitoxin; that these helpless little beings, who can not, often will not, give a history, should receive the benefit of all modern methods in diagnosis that they may enjoy normal respiration.

