ADENAGENOUS ETIOLOGY IN CERTAIN IRRITATIVE COUGHS IN CHILDREN

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Introduction

Much has been written about the cough.
Before — more than today — doctors cultivated the sense of observation when specifying their diagnosis.
With the advent of the stethoscope and the X-ray examination, semiology has been simplified substantially and coughs are now classified into two large categories: on the one hand the loose and productive coughs, on the other the dry and irritative coughs. The former serve a purpose; they permit the elimination of secretions or other undesirable matter and, as such, they must not always be combatted. To coin the saying of Chevalier Jackson: they are "the watchdog of the lungs". Sherrington classified these coughs among the nociceptive reflexes.
In the second category, dry coughs provide the proof of irritation at a spot sometimes difficult to localize. Infact they have no purpose, even if they appear to be caused view of eliminating the source of irritation. It is this type of cough that will be dealt with here, since an irritation giving rise to coughing and caused in certain cases by the simple presence of adenoids in the naso-pharyngeal roof, determines a dry and irritative cough.
Just as in yawning, hiccups and other movements connected with pulmonary ventilation, coughing is a respiratory reflex. This being the case, physiologically coughing is the resultant of a sensitive nerve and a motor nerve passage. The nasopharynx figures among the supra-laryngeal reflexogenous zones. And we shall see why this term appears preferable to that of supra-glottic. We shall also see that the pharynx, innervated by a very important plexus and dominated in its pathology by the presence of agglomerated lymphoid formations, represents the principal supra-laryngeal reflexogenous area of the cough. There even exists a form of pharyngitis of which the sole functional sign is the cough; it is a lateral pharyngitis that can be discovered only by retraction of the posterior pillar and which occurs in the form of longitudinal hypertrophical mucous strips.
We shall give details of a particular syndrome concerning which very little has been written: the nocturnal tickling cough in children caused by the presence of adenoids and apart from any inflammatory episode. We believe that it concerns a minor indication for adenoidectomy. It is certain that when the indication is correctly put, the cough definitely disappears with extirpation of the adenoids.
We insist on the fact that the irritative nocturnal cough can be the only

symptom and that it can exist without any other sign of adenoid hypertrophy. In consequence, this characteristic coughing represents an indication — albeit secondary — for the removal of adenoid growth.
Van Caneghem, Grimaud, Ameuille and many other authors have stressed the plurality of cough when envisaged from a pathogenous and from a finalist point of view.

— There is a variety of cough which springs from the sensations of secretions, of phlegm or of a foreign body in the respiratory tract and which tends toward the removal of these elements. This is the expulsion cough which Ameuille suggestively calls the "finalist cough" since its purpose is to reject unwanted matter.

— Opposed to this type of cough there exists a purely irritative cough started off by the irritation of a mucous area of the respiratory column and which, if it appears to have acted in order to calm this irritation, is nevertheless non-effective and even aggravates the irritation in some cases. Ameuille calls this dry, irritative non-productive cough a non-finalist cough. If the existence of this cough has never been denied — its frequency is even higher than that of the productive cough — it seems that its incidence is sometimes lost sight of by those who are called upon to give an opinion on the origin of this symptom in the different clinical cases submitted to them. In this connection, we will simply reproduce a quotation from literature noted by Ameuille and Turneau (1924); it concerns a person who suffered from a cough for 8 years and who, in spite of the negative pulmonary fields on X-ray photographs, was suspected of tuberculosis and had consulted numerous sanatoria. Then, on the occasion of an examination of the pharynx, it was noted that contact of the stylus with a certain zone of the pharyngeal mucosa located behind the left tonsillar pillar invariably caused a spell of typical coughing. A sub-mucous injection of xylocaine calmed the cough for 4 hours and the superficial cauterization of the zone concerned put an end to the cough.

— Somewhere about midway between the finalist and the non-finalist cough there is a relatively dry and nocturnal cough which affects some children suffering from sinusitis or inflamed adenoids. This cough, frequent in children who sleep on the back and which also appears a few hours after falling asleep, appears to prevent secretions from entering the tracheo-bronchial column. For this reason, Van Caneghem calls it a "barrier cough". But the commencement of this cough probably has an irritative component thus explaining its finalist and non-finalist character. Due to the likely preponderance of the finalist component, we could call it a "finalist barrier cough".
Van Caneghem, considering 100 cases of chronic sinusitis in children and classifying in order of frequency the spontaneous complaints described by the parents, finds the cough mentioned nine times only and, out of 11 different symptoms, it occupies the 5th place. On the other hand, for the same children, direct questioning showed that there was coughing in 70 cases. It can therefore be concluded that there is coughing in 70% of chronic sinusitis cases in children. But this cough is also found in adults and its sometimes productive nature can lead to its being confused with a finalist cough of a bronchial nature. Grimaud and Labaeye (1965) recall the case of a doctor

sent to Arcachon for an anti-tuberculosis cure although the sputum showed a sinusitis of dental origin.
Let us return to the syndrome of the dry cough due solely to the presence of adenoid growth while stating that this cough is typical of the group of non-finalist irritative coughs and, in particular, it must not be confused with the finalist barrier cough. If inflamed and secreting adenoid growth can be responsible for this cough, on the other hand, the presence of "latent" adenoids can, in our opinion, be responsible for the irritation of reflexogenous zones and cause the typical irritative cough forming part of the syndrome we describe in these pages.
In order to comprehend the "cough" phenomenon, it is necessary to answer the three following questions:
1° What is the point of application of cough irritation?
2° What is its nature?
3° To what extent is this irritation sentient?
We shall attempt to reply to these questions while considering successively the three types of cough mentioned above and we shall see to what extend these replies are vague, particularly as regards the irritating cough, and consequently, to what extent the cough is still a misunderstood respiratory reflex.

1. Finalist expulsion coughs

a. The zone of application of the irritation is broncheal or tracheal, but it is not easy to define further the points of application.
Two main cough-causing zones are generally admitted: the carina region, already mentioned by Vulpian in 1882, and the sub-glottic zone.
a. In spite of recent works by Widdicombe, the nature of the irritation of a finalist cough is not known with accuracy. In the case of phlegm or of a foreign body, who can say if the cough is determined by the mass, the consistance, the temperature, the chemical constitution or simply contact alone? We shall recall later on the types of receptors envisaged by Widdicombe.
c. When not sleeping, a tickling is generally felt just prior to expulsing the sputum. If irritation in this case is sentient it must be admitted that this consciousness is still somewhat obscure. The sensation experienced is assimilated to a tickling by analogy with the cutaneous irritation which determines this tickling, without a more specific control of the type of sensation being possible.

2. Finalist barrier cough

a. Here also, the point of application is not unique. It seems that the main zones are the pharyngeal zone and the supra-glottic portion of the larynx.
b. The nature of the irritation in most cases is represented by secretions of naso-sinusoid or rhino-pharyngeal origin. But here again, it is not possible to specify the actual quality of the secretions that set off the cough reflex.
c. The irritation is generally insentient, the child coughs during sleep, even if sleep is light. In other cases, the sensation can be likened to that of finalist coughs proper.

3. Irritative or non finalist coughs

It is for these coughs that the replies to the three above questions appear to be the most vague.

a. The points of application of an irritative cough are particularly numerous, comprising namely the upper respiratory tract, the tracheo-bronchial column, the pleura, the thoracic vessels, certain abdominal zones without omitting the external auditive canal wall which via the Arnold nerve electively sets off a spell of coughing in some persons.

We must insist here on the particular sensivity — and which varies from one subject to another — of the reglexogenous zones, especially those in which we are interested, namely the upper respiratory tracts. The nasal mucosa set apart, the irritation of which causes sneezing, a respiratory reflex different from the cough, it appears that it is the mucosa of the rhino-pharynx and of the posterior and lateral walls of the pharynx which is the most exitable. This excitability varies considerably with the subjects, a fact noted daily by otorhinolaryngeal specialists when proceeding with examinations. And it appears that there can be a recrudescence or a falling of the degree of excitability of a reflex zone, just as there can be a quantitative extension of cough-causing sensitivity, by the appearance of new reflex zones. An explanation for this change-over of reflexogenous zones cannot always be found. In some instances a catarrhal episode can explain the sudden re-appearance of a long extinguished reflexogenous zone.

Ameuille and Kudelski (1937) have shown that cough-causing zones can vary with age. These zones exist at birth but then they are nasal to move toward the posterior mucous zones as the child grows up. Some zones disappear with age. Whatever the reflexogenous zones, their sensivity diminishes with age.

We can now state that for the non-finalist coughs, the external or internal actions to be determined, create in certain persons more than others, for more or less a long time and on a variable portion of the mucosa, the cough-causing sensitivity characteristic of the irritative cough.

b. In this case, to a lesser degree than for finalist coughs, the irritation is determinable. There is an irritation of a reflexogenous zone or the active recollection of an earlier irritation. The original commencement can be spontaneous or can have for origin the contact with an object, with smoke or an engaging smell or an inflammation. The maintenance of this reflexogenous zone — we have in mind particularly the rhinopharyngeal mucosa laden with adenoid tissues — can be ensured until the irritative cause has disappaeared. Further, the agent which has determined the reflexogenous character of a zone can have been relayed by another agent, another stimulant. This is what we call the qualitative extension of the cough-causing sensitivity. We are pleased to have the opportunity of formulating a remark here which shows to what degree these problems are complex. We all know the existence of these vague, tenacious sensitivities particular to the pharyngeal sensations. Now, these do not generally determine cough, while the sensation carrying pharyngeal mucosa can be at the slightest touch an elective reflexogenous zone. Certain zones can therefore cause the feeling of an irritation without determining any cough-causing reflex but can also entail

a chronic irritative cough without an irritation being felt. This is explained in the following lines.

c. In most instances excitation of the cough is entirely or almost unconscious. The woman patient whose case we mentioned and was described by Ameuille and Tarneaud, did not feel and was unable to specify the pharyngeal point, origin of the reflex. This would also be the case for the child suffering from an irritative nocturnal cough caused by the simple presence of adenoid growth. Ameuille suggestively chose the term "decapitated respiratory reflexes" — under the circumstances the cough itself — but whose related component, the zone or departure of the excitation, is neither conscious nor often recognizable by another perception of control.

The chronic, recurring, iterative character of these coughs is explained on the one hand, by persistance of the irritation which sets off the cough, on the other, by the fact that the cough remains without effect on the reflexogenous zone and that, in particular, as for finalist coughs, it does not bring about elimination of the cause which sets off the cough. On the contrary, the impression is that the cough stimulates the cough. The children referred to in this paper do not cough during long hours of the night, but when cough does occur it seems incoercible and unable to be calmed.

Physiopathology of the cough

We shall recall briefly the nervous mechanism of the cough, a respiratory reflex.

With Pozzetto and Tramier (1962), we note that every movement of the cough is characterized by three phases whose harmonious sequence, as regards the productive cough at least, conditions its efficiency. These three phases are as follows:

1. A short inspiration.
2. An expiration with the glottis closed, accompanied by a contraction of the alveolar sphincters to avoid a dangerous hypertension in the pulmonary alveoli.
3. An expiration with the glottis open, brutally liberating the air compressed during the preceding phase, responsible for the "noise" observed during a fit of coughing.

Since the cough is a reflex it is fitting to distinguish successively the receptors, the centripetal nerve paths, the nervous point(s) and the motor nerve-organs.

— Receptors:

These are situated in the reflexogenous zones which we shall group into infra-laryngeal reflexogenous (bronchi-and trachea) and supra-laryngeal zones (pharynx, nostrils and annexes). Grimaud and Labaeye (1965) rightly prefer the sub-division between infra-glottic and supra-glottic zones since the upper laryngeal nerve, which ensures the greatest part of sensitivity of the larynx, possesses a supra-glottic ramose and a sub-glottic ramose. Cough receptors are not reliably specific.

Physiologically, Widdicombe envisages the existence of two types of receptors, the first sensitive to the pressure and the distension of the respiratory tracts, the second, more specifically, answering to very discreet tactile incitements (interepithelial and sub-epithelial terminals of Larsell and Elftman).

Widdicombe also admits the existence of intermediate receptors sensitive only to chemical stimuli. According to Pozzetto and Tramier, the physiological cough answers to stimuli of three orders:

- mechanical: dusts, bronchial distension subsequent to hyperventilation caused by effort for example.
- chemical.
- physical: excitation of a thermic or hygrometric nature.

— The centripetal paths:

Schematically speaking, the sensitive paths are as under:

- for the nasal mucosa: the trigeminal nerve.
- for the base of the tonque and a part of the pharyngeal mucosa: the glossopharyngeal nerve.
- for all other reflexogenous zones: the pneumogastric nerve due to its pharyngeal, laryngeal, tracheal, bronchial and bronchiolaire ramoses tangled with the peri-bronchial plexuses. The sympathic intervenes with fibres that this nerve supplies to these plexuses.

  The pneumogastric is therefore the most important reflexogenous cough-causing afferent nerve. By its auricular ramose which innervates the deep part of the external auditive duct and the tympan, the X nerve is also responsible for the cough reflex that any touching of the auditive duct electively causes in certain persons.

— the neural centres:

The coughing centre is autonomous and is situated roughly near the ambiguous nucleus, the respiratory centre and the vomiting centre. To the rear, it is adjacent to the solitary tract and the sensitive dorsal nucleus of the X. The centre of the cough is in connection with the afferent paths mentioned above and coming from the reflexogenous zones, and with the efferent paths, the pyramidal tract, the vagus and the sympathic and parasympathic fibres reaching the tracheo-bronchial column. There is probably a second cough centre, located in the region of the ala cinerea.

— The centrifugal paths:

These are of two types:

1. The cerebrospinal fibres of the pyramidal tract and in particular the phrenic nerve which causes the sudden contraction of the diaphragm. The motor fibres of the trigeminal and the facial nerve, of the hypoglossal and of Willis's accessory nerve, which control the harmonious development and the synergy of movements associated with coughing.
2. The sympathic and parasympathic fibres intervening in the broncho-motility and the broncho-secretion.

In conclusion, the nervous paths intervening in the cough are multiple, but it seems that both from the efferent and the efferent point of view, the pneumogastric nerve plays a preponderant role.

CONCLUSIONS

The cough of adenoid origin can be productive during an inflammatory period, and irritative when there is absence of inflammation. In the latter cases, it appears that the presence of adenoid growths can irritate the rhino-pharyngeal reflexogenous zone and cause a dry, recurring cough.

This cough is nocturnal, recurring at certain periods every night, sometimes

annoying others more than the child and representing one of the minor indications of adenoidectomy which alone, as we have observed on numerous occasions, will put an end to the cough.

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RÉSUMÉ

L'article rappelle d'abord la pluralité de la toux et distingue la toux d'expulsion ou toux finaliste, la toux irritative ou non finaliste et la toux de barrage, variété se situant à mi-chenin entre les deux précédentes. Ces variétés de toux sont étudiées du point de vue de leur origine, de leur nature et du caractère plus ou moins conscient de leur mécanisme.

La physio-pathologie de la toux est ensuite envisagée en passant en revue les récepteurs, les voies centripètes, les centres nerveux et les voies motrices.

Ces notions sont appliquées à un syndrome particulier au sujet duquel on a peu écrit: la toux irritative nocturne qui chez l'enfant peut avoir pour origine le seule présence de végétations adénoïdes, en dehors de tout épisode inflammatoire. Il s'agit d'une indication mineure de l'adénoïdectomie, laquelle met un terme à ce type de toux irritative nocturne.

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