

## Eustachian tube permeability during the nasal provocation test

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### SUMMARY

*The results of manometric study on the permeability of the Eustachian tube after a crisis has been produced by exposing 26 cases of perennial nasal atopy to the threshold-dose of the responsible allergen are reported.*

*In 73% of the cases a reduction of the permeability (16 cases) or a stenosis (4 cases) of the ipsilateral tube were found.*

*The importance of inquiring and specifically treating a nasal allergy in patients suffering from secretory otitis is underlined.*

ONE of the main causes of hypoacusia in children is undoubtedly represented by Secretory Otitis Media (S.O.M.), easily diagnosed disease but whose pathogenesis (either mechanical, allergic or bacterial) is still debated. Those who attribute an important role to allergy (Derlacki, 1952, 1957; Singleton, 1956; Weekes, 1958) base their opinions on the observation that frequent allergic reactions occur in the upper respiratory tract of children suffering from SOM (Lecks, 1961; Davison, 1966).

On the other hand, other authors state that primary responsibility should be attributed to infective agents (Silverstein, 1966), considering the fact that about 40% of cultures of middle ear effusions develop pathogens. The mechanical theory (ex vacuo) explains SOM as a secondary effect of the Eustachian tube stenosis followed by air-reabsorption and transudation. It is evident that, under certain conditions, a mechanism of this type can be the sole responsible for an endotympanic effusion; but it can be analogously stated that both bacteria and allergens, acting at the tubaric level, can cause it.

While the bacterial theory is in some cases fully justified, in other cases it can be criticized considering that an effusion can be an optimal culture medium for superimposed infection. As to the allergic theory, on the other hand, although it has had undirect demonstrations, it has however recently drawn the attention of one of us (Crifò, 1974) whose research was first of all aimed at demonstrating the possibility that the cavum tympani may be involved in an allergic (reaginic) immune-reaction. For the occurrence of such type 1 reaction, responsible for respiratory atopy, it is necessary in fact that some preliminary conditions are fulfilled: (a) sensitization of the middle ear mucous membrane by the allergen; (b) production and secretion of reagents by the local plasma cells; (c) presence of local

mast-cells that can fix reagins on their membranes; (d) possibility for the allergen to re-contact the sensitized mucous membrane.

Among these preliminary conditions, the first one is certainly demonstrable, because in atopy both the skin and the mucous membrane become variously reactive to the allergen.

The second and third conditions have recently had only generic demonstrations, recently verified by us (Crifò, 1974), through the detection of aspecific IgE in the exudate of SOM (Ishikawa et al., 1972) and the presence of mast cells (Ishikawa et al., 1972; Lim et al., 1973; Crifò, 1974) both in the normal and pathological middle ear mucous membrane.

At present, however, we lack demonstration of specific reagins in the middle ear effusions or at the level of the plasma cells. Moreover, also some attempts (Crifò, 1974) at provoking an allergic reaction spraying the allergen through a tympanic perforation in perennial nasal atopy have not been successful. On the other hand, the nasal provocation test, performed in 15 atopics, 11 seasonal and 4 perennial, did not bring about significative auricular symptoms in the next week.

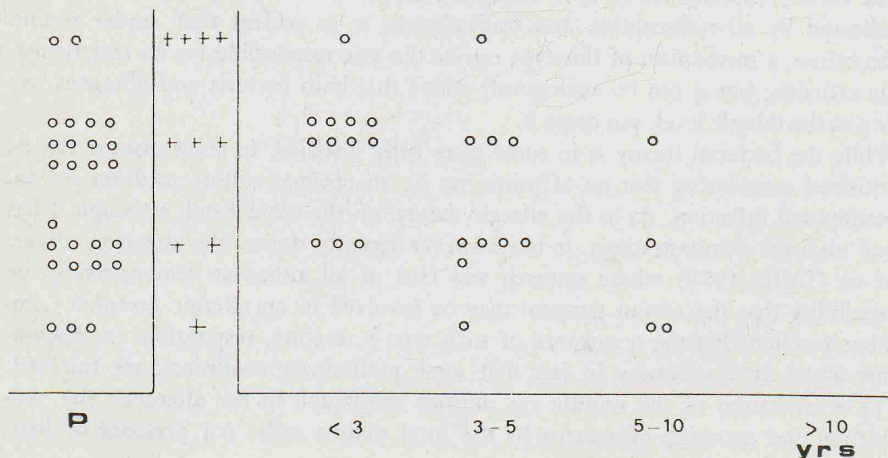
When concluding these preliminary studies we underlined the necessity for further investigations that could find out, using more idoneous means, whether in nasal atopy the eventual involvement of the cavum tympany must be considered a true reaginic phenomenon or either an aspecific mucous membrane response following the specific involvement of the Eustachian tube iuxta-pharyngeal tract.

This paper reports the results of an instrumental study of the behaviour of the Eustachian tube permeability after nasal crisis provoked in selected atopics.

#### MATERIAL AND METHODS

*Selection of patients.* 26 perennial nasal atopics by *Dermatophagoides pteronissimus* (D.pt.), 20 males, were selected at our Rhinology Centre on the basis of their high

Figure 1. Behaviour of the Eustachian tube function before (B) the challenge test, in relation to the years of illness.





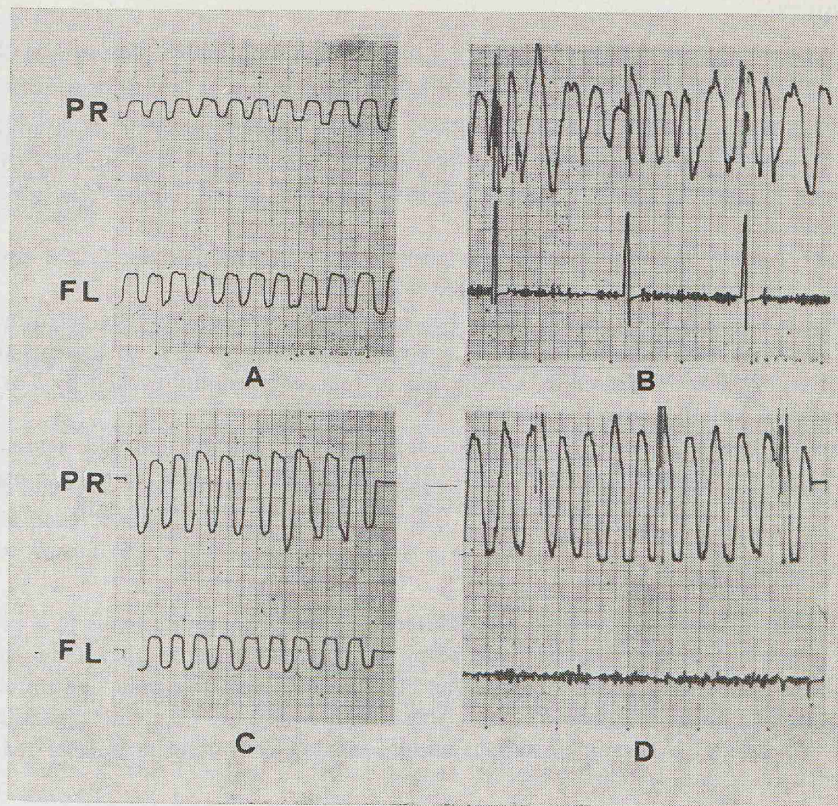


Figure 2. Tubaric function before (B) and after (D) positive nasal provocation test. A and C show the rhino-rheo-manometric diagrams as to the pressure (PR) and the flow (FL) in the nasal fossa following sprayed solvent only (A) and 50 PNU of allergen (C) (threshold dose for this patient).

skin positivity (-4 plus), of their age (8-20 years) and of the degree of their nasal mucous membrane lesion (1st and 2nd degree).

Five patients with perennial nasal atopy caused by *Parietaria officinalis* and skin-negative to D.pt. were considered as controls.

*Rhino-Rheo-Manometric (R.R.M.) nasal provocation test.* We followed the already described technique (Crifò et al., 1975) based on R.R.M. evaluation of the basal conductance fall ( $C = \text{flow/pressure}$ ) of one nasal fossa after spraying doses of 10, 50 or 100 PNU of allergen. Provocation threshold was considered the PNU dose able to cause a reduction of at least 20% of basal C.

*Study of the Eustachian tube permeability.* A few minutes after each allergenic stimulation the permeability of the ipsi-lateral Eustachian tube was studied by a manometric method recently reported (Crifò and Cittadini, 1976). This test evaluates the Eustachian tube permeability after Toynbee's and/or Valsalva's test in terms of stenotic (-), permeable (1-4 plus), and patent Eustachian tube.

## RESULTS

Figure 1 shows the results of Eustachian tube tests in each patient before (B) the nasal provocation test, referred to the years of illness.

It is evident that, along with the tendency towards chronicisation of nasal atopy, the Eustachian tube ventilation tends towards a reduction that is very probably consequent to repeated allergic crises and/or the association of possible bacterial superinfections.

Figure 2 shows the registrations of a positive nasal provocation test (A,C) complicated by Eustachian tube stenosis (D).

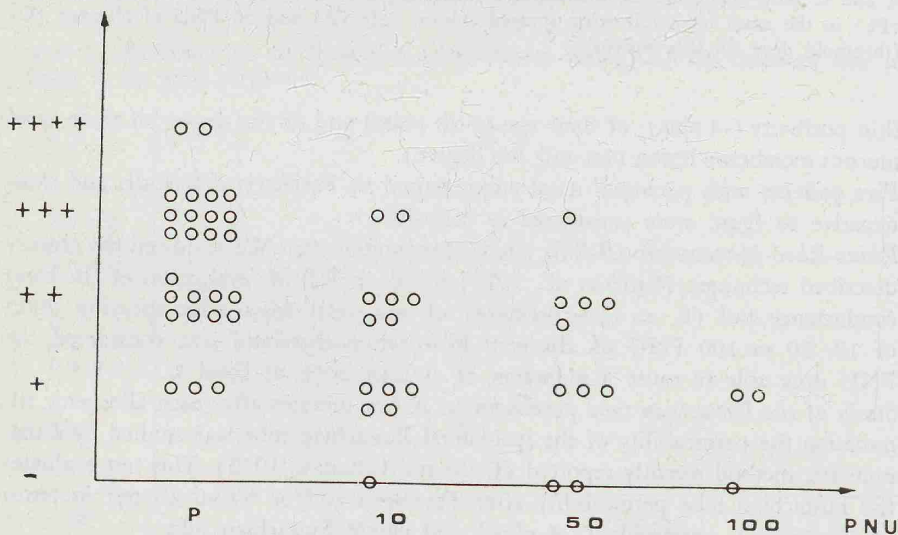
Figure 3 synthesizes the results of the Eustachian tube permeability tests performed at the provocation threshold-dose. Its analysis shows that in 77% of patients the nasal reaction was followed by a reduction of tube permeability evoked by Toynbee and/or Valsalva tests.

Complete stenosis occurred only in four cases (see fig. 1) associated with sense of ear pressure and autophonia (4 cases), slight hypoacusia (2 cases) and slight otalgia (1 case). The tubaric permeability was unchanged in six patients only.

## CONCLUSIONS

The above data seem to indicate that Eustachian tube permeability tends to a progressive reduction in perennial nasal atopy (D.pt.); furthermore, they show that in this frequent nasal atopy the crises can be often followed by a reduction in tube permeability up to complete stenosis. These results indicate, then, the possibility that in perennial nasal atopy insidious middle ear otites can occur because of redu-

Figure 3. Behaviour of the Eustachian tube function before (P) and after provoked nasal allergic crisis.





ced tubal permeability. In fact, even a reagin-induced partial reduction of the Eustachian tube permeability can be an adequate stimulus for that respiratory transformation that is to-day retained the main pathogenetic factor in S.O.M. Finally our results clearly indicate the necessity for allergological screening in patients affected by S.O.M., because in atotics the specific therapy should be undoubtedly considered as the only one capable to stop the progression of the middle ear disease.

#### RÉSUMÉ

On donne les résultats d'une étude manométrique de la perméabilité de la trompe d'Eustachio, conduite dans 26 cas d'allergie nasale après crise provoquée par exposition à la dose-seuil de l'allergène spécifique.

On a observé dans 73% des cas une réduction de la perméabilité (16 cas) ou une sténose (4 cas) de la trompe d'Eustachio du même côté stimulé.

On souligne l'intérêt de rechercher toujours dans des malades avec otite sécrétive une possible allergie nasale. En effet, dans ces cas, le traitement spécifique devrait être considéré comme la seule thérapie utile.

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