

## BACTERIOLOGICAL PROBLEMS OF THE UPPER AIR-PASSAGE

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The bacterial floras of different parts of the body differ widely. It is important that separation is maintained and also that other parts remain sterile. This is achieved through all kinds of protective mechanisms such as the coughing and sneezing reflexes, narrow ostia between the nose and sinuses, the narrow vocal slit between the nose and the bronchi. Narrow canals such as the ductus naso-frontalis and the Eustachian tube are equipped with a ciliary epithelium, able to remove bacteria by means of a protective mucuous film. The intact eardrum provides ideal protection. Thus if hygiene is sufficient, the flora of the skin, the intestine, the vagina, the nose, the mouth and the pharynx will be kept apart and the sinuses, the middle ear and the bronchi will remain sterile.

For the air- and food passages the transitions of the "milieu extérieur" to the "milieu intérieur" are the nose and the mouth. The anatomical border is the transition from skin to mucuous membrane, the psychological border is — for the nose — identical with the anatomical border, namely the very sensitive ostium internum, but in the mouth the protecting pharynx reflexes are situated much deeper, namely at the pharyngeal folds. The bacteriological border in the mouth is the same as the anatomical but in the nose the skin flora penetrates much deeper.

Thus in normal test-persons in the vestibulum and the outer part of the nasal cavity, the skin flora and inhaled bacteria will prevail. It is known that in hospital doctors and nurses but also in patients and even in visiting relatives the resistant staphylococcus aureus may be found. In the deeper parts of the nasal cavity a special nose flora will be present.

The nasopharynx and the adenoid, especially in children, is the main breeding place of viruses and bacteriae. From this one place they may spread to the nose, the ear, the bronchi and the sinuses. For this reason it does not surprise us that the bacteriology of these organs in acute as well as in chronic infection is very similar, provided that the difficult technique of taking the material and making the cultures is perfect. The normal bacterial flora of this junction of air and food passages consist of saprophytic living non aggressive pneumococci, streptococci, haemophilus influenzae and neisseria catarrhalis.

These innocuous germs may transforme into pathogenetic organisms by a change in their aggressiveness, in their number or in the resistance of the "terrain" on which they grow. In the case of infection they may also be overgrown by another, inhaled, pathogenetic microorganism.

Thus in acute infection of one or both ears the pneumococcus and the haemophilus influenzae and occasionally the streptococcus are found mostly in pure culture. To obtain reliable bacteriological results, the pus must be obtained by sterile puncture of the eardrum in order to enable contamination with staphylococci. Moreover the material must be done immediately in broth and placed in the incubator in order to preserve the haemophilus. The culture of haemophilus and the detection under the microscope needs an experienced

bacteriologist. The same holds true for nose-and bronchial smears and sputa.

According to Björkwall in 2/3 of his test persons the flora of the healthy nose consists of staphylococcus albus and coryne-bacteria. The pneumococcus and staphylococcus aureus may be found temporarily in the nose. The streptococcus, haemophilus influenzae and the micrococcus catarrhalis does not belong in the normal nose. Inhaled bacteria of other kinds and even fungi, dependent on the surroundings of the test person, may also be found.

In acute sinusitis as in acute otitis and bronchitis the offending micro-organism are mostly the pneumococcus and the haemophilus influenzae and occasionally the streptococcus and neisseria catarrhalis. Very often a pure culture is present and the same germ is found in the nose as in the sinus. Of course in diphtheria, scarlatina etc. special germs predominate in the throat and nasal cavities.

In chronic rhinitis and sinusitis several conditions may be distinguished:

1. On puncture of a clouded sinus sterile mucuous, with or without eosinophilic cells, may be obtained. After washing, the sinus may still be clouded and on the X-ray picture a considerable thickening of the mucous membrane may be seen. Nasal polyps might be present or not. In many of these patients, by means of skin testing and by taking a careful anamnesis, an allergic constitution can be established. If the mucuous or the nasal smears contain eosinophilic cells in abundance, a specific atopic allergy of the hayfever and house dust type must be suspected.
2. Due to retention of mucuous and obstruction of the ostium, micro organisms which while sneezing in nasal infection, are pressed through the ostia, will find good conditions for growth. Thus recurrent purulent sinusitis may be explained.
3. Chronic purulent maxillary sinusitis, a condition often unnoticed by the patient, is a very common disease, occurring in our estimation in about 5% of the urban population.

In allergic individuals this percentage is considerably higher. Indeed "L'allergie fait nid au infection".

Table 1

	total	pure cultures
Pneumococcus	105 (48.8 %)	14.4 %
Haemophilus infl.	101 (46.9 %)	11,7 %
Neisseria catarrhalis	31 (14.4 %)	1.4 %
Staph. aur. haem. coag.	28 (13.0 %)	4.1 %
Streptoc. viridans	27 (12.6 %)	2.1 %
Streptococcus haem.	12 ( 5.6 %)	2.8 %
B. Coliforme	11 ( 5.1 %)	0.8 %
Diphtheroide bacteriae	6 ( 2.8 %)	0.4 %
Klebsiella ozaenae	2 ( 0.8 %)	0.4 %
Proteus vulgaris	1 ( 0.4 %)	0.4 %
No growth	17 ( 7.9 %)	

Bacteria cultivated in 215 cases of chronic purulent sinusitis  
Bactéries cultivées en 215 cas de sinusite purulente chronique

In our clinic 215 cases of chronic purulent sinusitis were studied. It appeared that again the pharyngeal flora, the pneumococcus, and the haemophilus influenzae were the predominating micro-organisms, not seldom seen in pure culture. (Table 1). Occasionally the fecal flora was found but not so often as the staphylococcus. In this respect chronic sinusitis and chronic bronchitis differ from chronic otitis in which disease the pharynx flora is superseded by the skin and fecal flora. Presumably the ear is too much exposed to the unhygienic exploring finger of the patient.

Bacterial allergy might be another answer to the question why an infection becomes chronic or manifests itself in recurring attacks. Indeed in most persons sinus infections are cyclical and only occasionally the infection persists.

Probably in such patients the hyperergic infectious phase is not immediately followed by immunity, but an allergic phase, in which the patients may show all the symptoms of vasomotor rhinitis, follows. The bacteria which might be responsible for such a bacterial allergy are again the haemophilus-influenzae and the pneumococcus. The latter one is a transient micro-organism which is sensitive to antibiotics and living on the surface, whereas the haemophilus is a resident living between the cells of the epithelium.

Especially in its dormant phase this germ shows very little sensitivity to antibiotics.

As early as 1939 Mulder stated the important role of the haemophilus influenzae in the pathogenesis of acute and chronic bronchitis and asthma. As stated we found this micro-organism in very high percentages in sinusitis and otitis. According to Goslings in asthmatic bronchitis the uncapsuled haemophilus (the relatively benignant form) is nearly always present for long periods, whereas the pneumococcus is present for short periods. Very important for our understanding of the role of the haemophilus is the fact that this micro-organism can be activated by viral infections as influenza and common cold and thus pass from its dormant into the aggressive stage.

Table 2

	Number of cases of sinusitis	Odontogenous
Hajek (1899)	200	6.5 %
Hauenstein (1922)	68	16.9 %
Berry (1928)	225	22 %
Amerbach (1938)	106	28 %
Wassmund (1939)	531	32.2 %
Nail (1941)	70	13 %
Barth (1943)	578	12.3 %
Hempstead (cit. Cook 1947)	386	22.5 %
Bjök (1954)	1019	4.6 %

**Some statistics on the occurrence of odontogenous sinusitis**

**Quelques statistiques concernant la fréquence de la sinusite odontogène**

From a comparison in our clinic of patients suffering from pneumococcal infection and haemophilus infection it appeared that the course of the disease



was much worse in haemophilus infection especially when combined with allergy.

Odontogenous infection is often mentioned as a cause of chronic sinusitis, especially in children. The figures we find in literature differ extremely. Thus as against the high figures in the dental centres, we may state the opinion of the rhinologist Voss, who said that sinusitis from exclusive dental origin does not exist. The explanation might be that different groups of patients visit the dental- and E.N.T.-Departments.

In our own material in 85 patients suffering from one-side sinusitis dental granulomata were seen in 4 of them. However in 100 patients suffering from bilateral sinusitis, bilateral granulomata were never found.

Odontogenous sinusitis is characterised by the fetid secretion caused by anaërobic micro-organisms.

As well in chronic sinusitis as in chronic bronchitis fetid purulent secretion with anaërobic bacteria is very often correlated with metaplasia of the epithelium of the mucosa.

As allergy favours infection and, most probably, chronic infection promotes allergy, the patient can only be saved from this vicious circle by the efforts of the allergy-conscious rhinologist.

### PROBLÈMES BACTÉRIOLOGIQUES DES VOIES RESPIRATOIRES SUPÉRIEURES

Le nasopharynx avec ses végétations lymphoïdes est la couveuse des bactéries et des virus. Dans le nasopharynx normal ces bactéries — le pneumocoque, l'haemophilus influenzae, le streptocoque et le neisseria catarrhalis — vivent en saprophytes inoffensifs.

En cas de changement de virulence, changement de résistance de l'individu ou en cas de surinfection, ces bactéries de la flore pharyngienne se propagent et sont la cause d'une otite, bronchite ou sinusite aigue.

En cas d'infection chronique par manque d'hygiène, la flore cutanée et la flore fécale peuvent se surajouter. C'est surtout le cas dans l'otite moyenne chronique où la flore pharyngienne est complètement supplantée. Dans les sinusites et bronchites chroniques la flore pharyngienne — les pneumocoques et l'haemophilus — restent prédominants.

Ainsi on trouve une infection manifeste au bacille haemophilus influenzae et au pneumocoques chez 50% des patients atteints de sinusite. Le premier germe se trouve très souvent dans une phase silencieuse vivant entre les cellules de la muqueuse comme hôte permanent, étant très peu sensible aux antibiotiques, tandis que le pneumocoque vit sur la surface comme hôte temporaire et peut aisément être chassé par une cure d'antibiotiques.

L'haemophilus peut être activé par toute infection virale.

Dans notre opinion une sinusite chronique d'origine dentaire pure ne se voit pas souvent, contrairement à l'opinion de plusieurs autres auteurs.

La sinusite fétide peut être d'origine dentaire, mais peut également aller de pair avec une metaplasie de l'épithélium de la muqueuse comme dans les cas de bronchite fétide. L'évolution défavorable de la sinusite chronique est

souvent le résultat de l'existence d'une allergie combinée avec une infection par l'haemophilus. Une allergie bactérienne à l'haemophilus se manifeste probablement par une rhinite vasomotrice. En conséquence l'allergie favorisant l'infection et l'infection créant l'allergie le malade ne peut être soustrait de ce cercle vicieux que par les efforts du rhinologue compétent en allergie.

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