

STUDIES OF MAXILLARY OSTIUM PATENCY AND RESISTANCE IN ACUTE MAXILLARY SINUSITIS

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Proetz (1932) found that pressure changes during respiration are identical in the maxillary sinus and the nasal cavity in normal conditions, i.e. when the maxillary ostium is open. Drettner (1965) reported results of investigations of ostial patency in different types of nasal and paranasal inflammations. He distinguished three types of ostial patency: 1. patent ostium, 2. partially obstructed ostium and 3. ostial obstruction during ordinary respiration. In the latter type three further subtypes were distinguished: a. a patent ostium after blowing or sniffing, b. a valve, c. an obstructed ostium on blowing and sniffing. He found an obstructed ostium in about every second case of acute maxillary sinusitis. Drettner (1965) measured the resistance of the maxillary ostium by determining the pressure needed to bring about irrigation of the sinus. This pressure was found to vary from less than 10 cm up to over 100 cm of water. In acute sinusitis, the pressure was 31 cm of water on average and less than 10 cm of water in 6 of 35 cases.

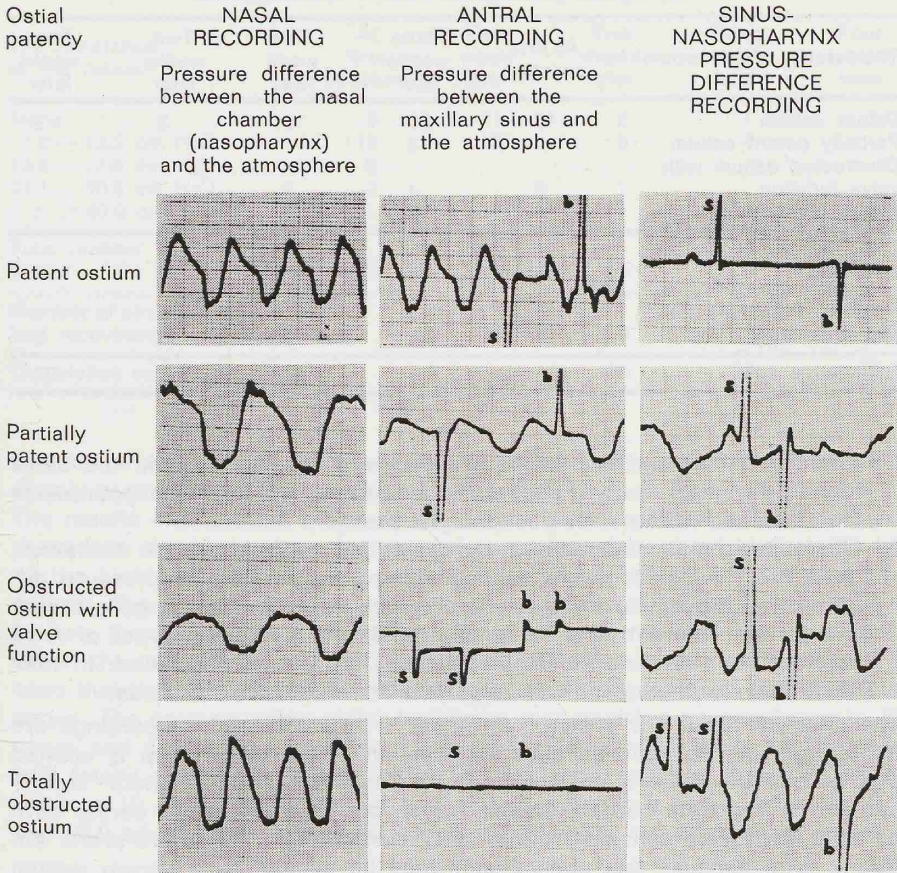
This paper is a preliminary report of results of studies in which changes in ostial patency and resistance were followed during the course of acute maxillary sinusitis. The apparatus used for pressure recording in patency tests is a rhinomanometer provided with a differential pressure recorder (Elema-Schönander EMT 33) and a Mingograph recorder.

In studying ostial patency, we have followed the principles proposed by Drettner (1965) and Cottle (1968). Our procedure is the following.

The respiratory cycles inside the maxillary sinus are recorded through a Lichtwitz trocar; actually this recording gives the pressure difference between the maxillary sinus and the atmosphere. In addition, we measure directly the pressure difference between the maxillary sinus and the nasopharynx by connecting one end of the pressure transducer to the opposite nostril. This part of the procedure is very useful in revealing whether or not small differences in the amplitude of the respiratory oscillations between the nasal and the antral recordings are due to changes in nasal resistance during the procedure. It also facilitates a decision as to the type of ostial disturbance. The resistance of the ostium was studied by determining the excess pressure needed to irrigate the sinus when the surface of the irrigating fluid in the drip chamber is held at the level of the ostium. The excess pressure is produced by an air pump connected to the space above the fluid level. A manometer connected to the same space records the pressure needed to cause the irrigation fluid to drop from the nose.

The series comprises 25 outpatient department subjects with acute sinusitis;

Figure 1. Pressure recordings in different types of maxillary sinus patency.



The same calibration (a 10-mm oscillation on the paper represents a pressure of 20 mm of water) was used in all the graphs. s = the patient was asked to sniff. b = the patient was asked to blow.

11 of these were bilateral and 14 unilateral cases. The X-ray findings in all the sinuses were typical of sinusitis and only cases with positive irrigation and respiratory pathogens in the secretion were included. All the cases were untreated when studied the first time. The main therapy was antral irrigation once a week combined with antibiotic treatment. The ostial patency and resistance were studied at every visit, i.e. once a week until recovery. A sinus was considered to have recovered only if, in addition to a negative irrigation, an open ostium was found.

The types of ostial patency distinguished in this paper are:

1. Patent ostium: respiratory cycles inside the sinus are identical with those in the nasal cavity; no oscillations in the pressure difference between the maxillary sinus and the nasopharynx.

Table 1. Results of maxillary ostium patency tests.
The figures give the numbers of sinuses tested.

The patency of the ostium	At first puncture	Three weeks later	One week later	Two weeks later	Four weeks later
Patent ostium	15	26	10	3	2
Partially patent ostium	1	3			
Obstructed ostium with valve function	6	4	3		
Totally obstructed ostium	14	3	2	3	1
Total number of sinuses examined	36	36	15	6	3
Number of sinuses that had recovered		21	9	3	2
Cumulative sum			30	33	35

- Partially patent ostium: respiratory cycles are smaller inside the sinus than in the nasal cavity. Respiratory oscillations are observed both inside the sinus and in the sinus-nasopharynx pressure difference.
- Obstructed ostium: no respiratory cycles are recorded inside the sinus. Respiratory oscillations are seen in the sinus-nasopharynx pressure difference recording. In ostial obstruction with valve function large pressure changes are transmitted to the sinus or/and from it. Different types of valve (inlet valve, outlet valve, combinet valve) are not distinguished. In total obstruction neither a sniff nor a blow is transmitted to the sinus.

The different types are depicted in Figure 1 in which actual recordings are photographed. The common initial obstruction of the ostium that is opened by a sniff or by a blow is not considered significant and represents a "technical error". The term partially patent ostium corresponds to the earlier term partially obstructed ostium (Drettner 1965, Kortekangas, 1970). We prefer the former term because this phenomenon may be caused by a narrow ostium itself or by a narrowing elsewhere between the ostium and the pressure transducer.

Cases, not analyzed in detail in this connection, in which very greatly attenuated pressure changes were recorded inside the sinus in connection with a vigorous sniff or blow, are occasionally encountered. We have considered a sniff or a blow pressure change less than 20 mm of water inside the sinus a sign of a total obstruction.

The results of the patency tests are presented in Table 1. All the tests considered in this table are made before irrigation in connection with the antral puncture. As can be seen from Table 1, there frequently are cases in which an open ostium is found in spite of abundant secretion inside the maxillary sinus. Recovery followed in all but one case of this series. The recovery was associated with conversion from obstructed to patent ostium in cases with initially obstructed ostium.

An obstruction persisting for more than three weeks may be a sign of poor prognosis as the only case without recovery persistently showed an obstructed ostium and continuous retention of secretion. The only deterioration seen in

Table 2. Results of maxillary ostium resistance tests.
The figures give the numbers of sinuses tested.

The resistance of the ostium	At first puncture	One week later	Two weeks later	Three weeks later	Four weeks later
None	9	21	8	1	3
1.0 — 13.5 cm H ₂ O	15	15	5	4	
13.6 — 27.0 cm H ₂ O	9				
27.1 — 40.0 cm H ₂ O	2		1		
> 40.0 cm H ₂ O	1		1	1	
Total number of sinuses tested	36	36	15	6	3
Number of sinuses that had recovered		21	9	3	2
Cumulative sum			30	33	35

this series was due to an acute bacterial superinfection; still this case completely recovered in four weeks.

The results of the ostial resistance tests are given in Table 2. The result no resistance means an open ostium and is explained by the fact that the tip of the Lichtwitz trocar inside the sinus is located below the level of the ostium. This small difference in level is enough to cause the irrigation fluid to flow through the drip chamber, which flow is a very sensitive indicator. When the ostial patency and the ostial resistance tests are compared, it is seen that there are 60 cases with an open or a partially open ostium in our series. The corresponding ostial resistance test revealed no resistance in 36 cases and a resistance less than 13.5 cm of water in 24 cases. In 23 cases with totally obstructed ostium, the ostial resistance was less than 13.5 cm of water in 10 cases, between 13.5 and 27.0 of water in 8 cases, between 27.1 and 40.0 cm of water in 3 cases and more than 40.0 cm of water in 2 cases.

SUMMARY

Maxillary sinus ostium patency was studied during the course of purulent sinusitis in 25 subjects with 36 affected sinuses. An open ostium was found in spite of retention of purulent secretion containing respiratory pathogens in about every other sinus. Recovery from sinusitis is correlated with a conversion from an obstructed to a patent ostium. The patency test seems to be more sensitive than the resistance test in revealing an ostial disturbance. A correlation between the results of the two tests is nevertheless apparent.

RÉSUMÉ

La perméabilité des ostia maxillaires est étudiée pendant la course des infections purulentes dans 36 des sinus qui furent affectées parmi 25 des sujets. Il y avaient des ostia ouverts malgré une rétention de la sécrétion purulente. Le pus contenait des pathogènes respiratoires dans la moitié des cas. La récupération d'une sinusite est corrélée avec la réouverture d'un ostium obstrué.

Il paraît que le test de la perméabilité est plus sûre que le test de la résistance pour révéler une interruption ostiale.

Tout de même il est clair qu'il y a une corrélation entre les deux tests.

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