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Patency of the nasofrontal duct during frontal sinusitis

Lars Andréasson, Åke Elner, Alf Ivarsson and Magnus Jannert, Lund, Sweden

SUMMARY

In a series of frontal sinuses trephined due to frontal sinusitis the airway resistance of the nasofrontal duct was tested during the healing period as well as in a long-term follow-up study up to one year. The nasofrontal duct was more resistant to passage for air than for saline during the healing period. A high incidence of recurrences was found in cases with high airway resistance of the duct, a prolonged primary healing period and when major nasal pathology was found.

The nasofrontal duct is normally open but its patency for air during and after an acute frontal sinusitis has hitherto not been tested. The usual way of treating a frontal sinusitis after the trepanation is by instillation of sterile saline until passage has been obtained. However, this procedure gives no information about the airway resistance of the duct. With a device specially designed for this purpose we therefore simultaneously measured the airway resistance of the nasofrontal duct as well during the primary healing period as in a follow-up study on a series of frontal sinuses, trephined due to frontal sinusitis, with the following aims, viz.:

1. to study the capacity of the nasofrontal duct during the primary healing period;
2. to calculate the resistance of the nasofrontal duct;
3. to define any possible "risk groups", i.e. a group where recurrences might be expected.

Indications for trepanation of the frontal sinus were severe headache and/or tenderness to palpation over the frontal sinus and positive radiographic findings.

METHOD

Figure 1 shows the equipment for recording air-flow ($\dot{V}$) through the nasofrontal duct and pressure difference between the nasal cavity and frontal sinus ($P_n - P_f$). The flow-meter is connected to the frontal sinus drain for measurements during

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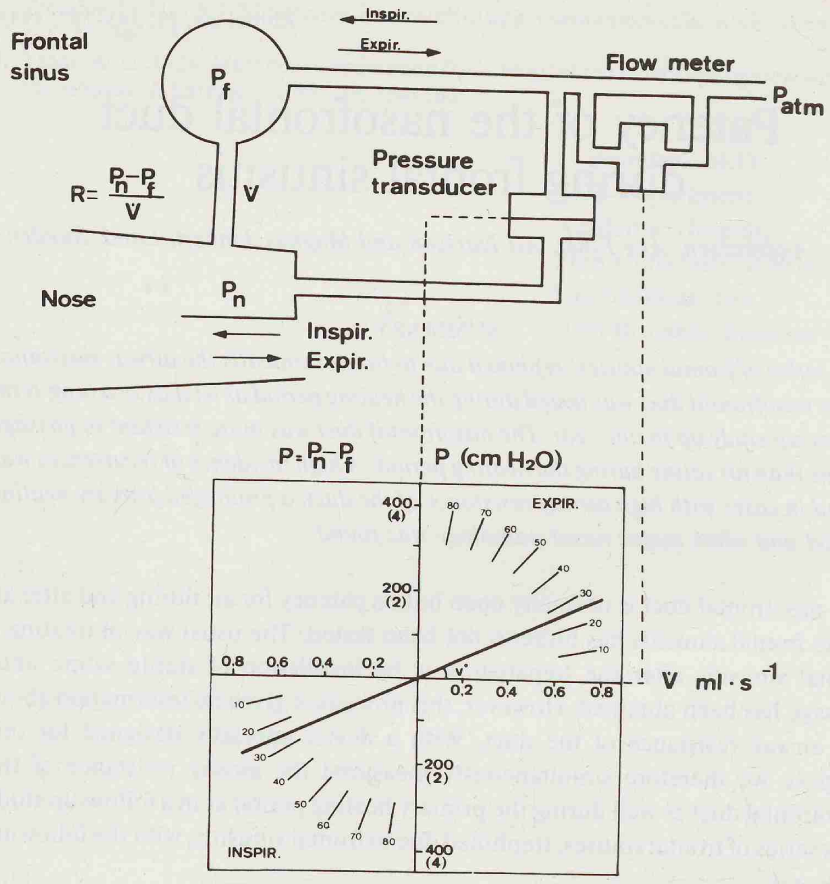

Figure 1. Block diagram of the equipment used.

the primary healing period. For the follow-up study the flow-meter is connected to a Venflone 170 percutaneously inserted through the burr hole in the floor of the frontal sinus.

The pressure difference between the nose and frontal sinus is measured by a differential pressure transducer and the pressure and flow signals are amplified, recorded and stored in an oscilloscope (510 Tektronix). The airway resistance can be calculated from the P–$\dot{V}$ curve as $= 0.5 \cdot \tan v^0$ in cm $H_2O/ml \cdot s^{-1}$. As the curve is virtually straight, the angles from different measurements can be compared directly. For further information see Andréasson et al. (1982).

TEST PROCEDURE

The patient is connected to the equipment and tested in upright position. First

the existance of free air communication between the frontal sinus and flow-meter is checked by recording of pulse waves from the mucosal vessels. If air communication is found between nasal cavity and frontal sinus during nasal breathing with the mouth closed, a pressure-flow curve is recorded. If not, the following tests are performed:

a. Valsalva's manoeuvre;
b. reversed Valsalva's manoeuvre;
c. forced inspiration test (sniff test);
d. forced expiration test.

CLINICAL PROCEDURE

After trepanation and bacteriological culture a standard drain was inserted. Pc–V 1.6 g × 2 and nosedrops were routinely given and the antibiotic treatment was modified according to the resistance pattern. The patency test was done on the 2nd, 4th and 6th day as described. When there was no passage for air, the sinus was irrigated with saline after the test.

The drain was not removed until some degree of patency was demonstrated. Two, six and twelve months postoperatively the patients were reexamined with patency test.

RESULTS

Healing period (0–16 days)

Passage for air during spontaneous nasal breathing was obtained in 7 out of 49 cases on the 6th postoperative day, while 42/49 could force the duct open by Valsalva's manoeuvre.

Figure 2 compares the passage of air (solid line) with that of saline solution (dotted line) in relation to time. On the 2nd postoperative day 24 out of 49 ducts could not be forced open by Valsalva's manoeuvre and 12 showed no passage of saline during irrigation. On the 4th day the corresponding figures were 12 and zero, respectively. Not until the 16th postoperative day the Valsalva's manoeuvre could force the duct open in all cases.

Follow-up period

Of the 49 trephined sinuses 46 were retested and the results given are from the 12-month control. Of the 46 tested 23 showed passage for air during nasal breathing. All were without clinical signs of sinusitis when tested but 6 had had recurrences during the observation period. The mean airway resistance expressed as the angle v^0 between the curve and the horizontal axis was 58^0 for these cases as compared to 17^0 for the 17 cases without recurrent disease. The difference is statistically significant ($p < 0.001$). As for the 23 sinuses without

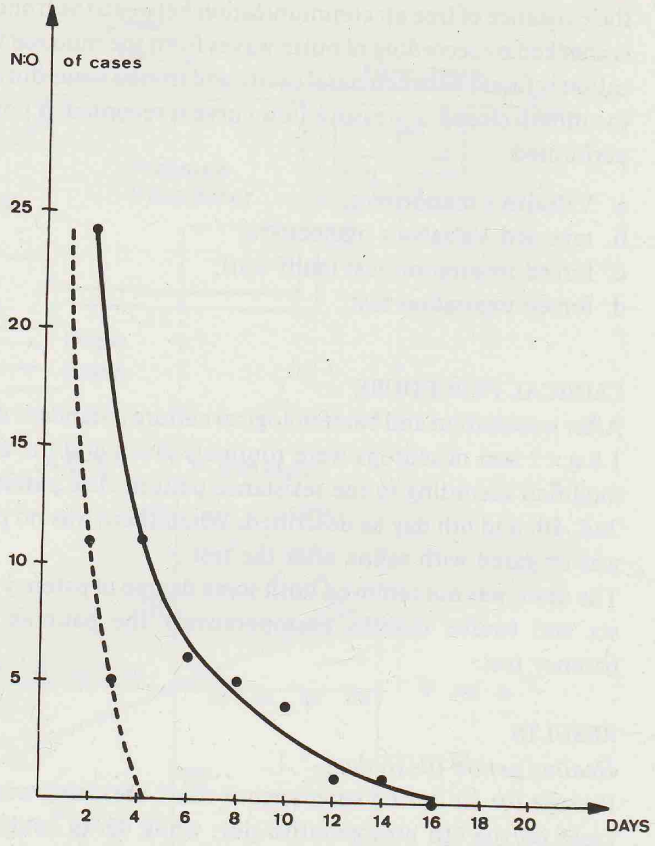

Figure 2.
Number of cases (dots) with no passage during Valsalva's manoeuvre (solid line) and the corresponding numbers of cases with no passage on irrigation with saline (dotted line).

patency for air at the 12-month test 13 showed recurrent disease during the 1-year observation time.

An increased tendency to recurrent disease was found among patients with a long primary healing period. Of 29 patients without passage for air or only passage at Valsalva's manoeuvre on the 6th postoperative day 16 (55%) showed recurrences during the first year, while patients showing patency for at least one test out of Valsalva's manoeuvre on the 6th day showed recurrences in only 3/30 cases (15%).

The recurrence rate was also found to be high in cases with major nasal pathology. Totally 9/46 had notable nasal pathology and six of them showed recurrences during the observation period.

CONCLUSIONS

Passage for air is obtained later than for saline during the primary healing period. A high incidence of recurrent disease might be expected in cases with a high air-

way resistance of the nasofrontal duct, a prolonged healing period and when major nasal pathology is found.

ZUSAMMENFASSUNG

Der Luftwegswiderstand durch den Ductus naso-frontalis ist an Fällen von Trepanation wegen Stirnhöhlenentzündung während der Abteilung und bei Verlaufskontrollen nach bis zu einem Jahr ermittelt worden. Während der Abheilung wies der Ductus nasofrontalis einen grösseren Widerstand gegenüber Luft als gegenüber Kochsalzlösung auf. Eine vermehrte Anzahl von Rückfällen wurde festgestellt bei hohem Luftwegswiderstand im Gang, bei verlangsamter primärer Abheilung und bei schwerwiegenden pathologischen Zuständen der Nase.

REFERENCES

1. Andréasson, L., Elner, Å., Ivarsson, A. and Jannert, M., 1982: The airway resistance of the nasofrontal duct during and after acute frontal sinusitis. Clin. Otolaryngol. (in press).

Lars Andréasson, Ass. Prof.
Dept. of Otorhinolaryngology
University of Lund
Malmö General Hospital
S-214 01 Malmö
Sweden