

STUDIES OF ANTIBIOTICS IN SINUS SECRETIONS

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Most patients suffering from paranasal sinusitis are treated with some kind of antibiotics. There are discussions whether to give the substance locally or systematically. This question arises from the fact that a high concentration of antibiotics in the serum does not always mean sufficient therapeutic concentrations in the infectious focus.

Earlier studies (Gullers, Lundberg and Malmberg, 1969 and Lundberg, Gullers and Malmberg, 1968) showed that doxycycline given orally reaches a concentration in the sinus secretion which is sufficient for treatment of purulent maxillary sinusitis. Penicillin given orally did not have the same ability to penetrate.

To continue these studies we decided to give simultaneously both penicillin and tetracycline to patients suffering from purulent maxillary sinusitis. This procedure allowed us to study the penetration capacity of two different antibiotics under identical conditions.

Our material consists of 13 patients with unilateral purulent maxillary sinusitis, and 2 patients with bilateral sinusitis. The patients were given both 250 mg tetracycline and 400 mg penicillin V acid orally four times daily. Blood samples were taken from the cubital vein and sinus secretions were aspirated after puncture of the maxillary sinus with a Lichtwitz needle. The samples of blood and secretion were taken before treatment, and every second or third day after the beginning of treatment.

The paper disc method (Ericsson, 1960) was used for determination of the antibiotic concentrations. Penicillin determinations were made on blood agar plates containing magnesium sulphate, which inactivates tetracycline. *Staphylococcus aureus* 209 was used as test strain. Tetracycline determinations were made by using *Bacillus cereus* as test strain. This strain is very sensitive to tetracycline, but resistant to penicillin even in high concentrations. We tried to classify the severity of the sinus infections according to the type of secretion (Table 1).

Table 2 shows the tetracycline concentrations in serum and sinus secretion in the first specimens taken after the treatment had begun. The serum con-

Table 1. Classification of sinus infections

Type of aspirated secretions	Type of infection
Serous	Type I
Mucous	Type II
Purulent	Type III

Table 2. Concentrations of tetracycline in serum and sinus secretions

Dose:	Purulent infections (type III)			
	Serum		Sinus secretions	
250 mg x 4	Mean value:	3.0 $\mu\text{g/ml}$	Mean value:	2.2 $\mu\text{g/ml}$
	Min.	2.1 $\mu\text{g/ml}$	Min.	0.6 $\mu\text{g/ml}$
	Max.	6.0 $\mu\text{g/ml}$	Max.	3.6 $\mu\text{g/ml}$

Table 3. Concentrations of penicillin V acid in serum and sinus secretions

Dose:	Purulent infections (type III)			
	Serum		Sinus secretions	
400 mg x 4	Mean value:	0.7 $\mu\text{g/ml}$	Mean value:	0.1 $\mu\text{g/ml}$
	Min.	< 0.1 $\mu\text{g/ml}$	Min.	< 0.1 $\mu\text{g/ml}$
	Max.	1.8 $\mu\text{g/ml}$	Max.	0.6 $\mu\text{g/ml}$

Table 4. Penetration coefficient of tetracycline and penicillin V acid

	Purulent infections (type III)	
	Mean value:	Max. / Min.
Tetracycline	0.7	1.6 / 0.2
Penicillin	0.1	1.6 / 0

Table 5. Penetration coefficient of tetracycline and penicillin V acid

	Healing infections (type I or II)	
	Mean value:	Max. / Min.
Tetracycline	1.1	2.3 / 0.5
Penicillin	0.6	1.0 / 0.2

centrations were fairly high (mean value 3.0 $\mu\text{g/ml}$). The corresponding values for sinus secretion were also high. However, the range between the maximal and minimal values was rather large.

The concentration of penicillin V acid is shown in table 3. The serum concentrations are much lower than those of tetracycline. Some values were below the minimal measurable concentration (0.1 μg). The corresponding concentrations in the sinus secretion were also very low. Half of the values were below 0.1 μg .

To facilitate a comparison between the penetration capacity of the two antibiotics we have calculated the relation between the concentration in the secretion and that in the serum. This relation is called the penetration coefficient. Table 4 shows the penetration coefficient for the first specimens taken after starting the treatment. All the infections were purulent (type III). The difference between penicillin and tetracycline is obvious.

The same calculations for healing infections can be seen in table 5. Type III infections had then changed to type I or II. The table shows that the difference between the penetration capacity for the two antibiotics had decreased. The penetration coefficient for penicillin was about six times that of type III infections. In contrast, the coefficient for tetracycline had not even doubled.

SUMMARY

The ability of penicillin V acid and tetracycline to penetrate the mucosa of the maxillary sinus was determined in 15 patients suffering from purulent maxillary sinusitis. Each patient was given both penicillin and tetracycline. The two antibiotics have different ability to penetrate the infectious sinus mucosa. The tetracycline passed from the serum to the sinus secretion in patients with severe, as well as mild inflammations. In contrast, the maxillary secretion contained measurable concentrations of penicillin only during the healing stage of the infection.

RÉSUMÉ

La faculté de pénétration de la pénicilline V (acide) et de la tétracycline dans la muqueuse d'un sinus maxillaire a été déterminée chez 15 malades présentant une sinusite maxillaire purulente. Chaque malade obtient au même temps la pénicilline et la tétracycline.

Il fut constaté que la tétracycline passait amplement du sérum dans la sécrétion sinusale même dans des conditions inflammatoires très marquées et ceci à l'inverse de la pénicilline qui n'atteignit des concentrations mesurables dans ces mêmes sécrétions qu'à la guérison de l'infection.

REFERENCES

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