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The treatment duration of acute maxillary sinusitis: How long should it be? A nasal smear controlled study*

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SUMMARY

The aim of this study was to determine the most appropriate duration of treatment in acute maxillary sinusitis. The study was performed prospectively on 40 adult patients with acute maxillary sinusitis diagnosed by sinus puncture. Patients were randomized as to several treatment periods and treated by various antibiotics according to culture-sensitivity results. Patients in group 1 received treatment for 7 days; groups 2, 3, and 4 received 14, 21, and 28 days, respectively. The patients were followed up with nasal smear findings on certain intervals during the 56-day follow-up period. Statistically significant differences were found beginning from the 21st day between group 1 and the other groups. However, there were no statistical differences among groups 2, 3 and 4. These findings show that the most appropriate duration of treatment in acute maxillary sinusitis should be at least 14 days according to nasal smear results.

Key words: acute sinusitis, nasal smear, treatment, antibiotherapy

INTRODUCTION

Acute maxillary sinusitis (AMS) is an acute inflammatory process of the mucous membrane of the maxillary sinus, and is regarded as an abscess or empyema. The majority of acute bacterial-sinusitis episodes occur subsequent to viral upper respiratory tract infections (Schwartz, 1994). The diagnosis of AMS is usually based on symptoms and clinical examination alone (Varonen et al., 2000). Certain major and minor criteria are described to aid in the diagnosis of sinusitis (Shapiro et al., 1992). Major criteria are purulent nasal and pharyngeal discharge, and cough. Minor criteria are periorbital edema, headache, facial pain, tooth pain, earache, sore throat, foul breath, increased wheeze, and fever. The presence of two major or one major plus two or more minor criteria for more than 7 days signifies acute sinusitis. Radiography and computed tomography (CT) have been used as reference standards in the diagnosis of sinusitis. The problem with both of them is that they may produce a number of false-positive findings. There is also evidence that patients with common cold and even healthy people may have pathological findings on the CT of sinuses (Calhoun et al., 1991; Gwaltney et al., 1994). On the other hand, sinus puncture is considered as the gold standard in the diagnosis of sinusitis, however, it is an invasive method. Investigations of other methods for diagnosis and treatment of sinusitis have already been under way. We have reported previously that nasal smear could be used in the diagnosis and treatment follow-up of experimentally induced AMS (Kutluhan et al., 1997).

The aim of this study was to determine the most appropriate duration of treatment in adult patients with bacterial AMS and to investigate whether a linear correlation is present between nasal smear findings and symptoms of AMS at the time of diagnosis and the follow-up period.

MATERIAL AND METHODS

This study was performed prospectively on a selected group of 40 patients who admitted to our clinic between 1998 and 2001. Ages ranged from 16 to 45 years (mean age 29 years). The patients, diagnosed with bacterial AMS subsequent viral upper respiratory tract infection without any history of acute sinusitis within the last six months were included in the study. Patients with chronic sinusitis, recurrent acute sinusitis, acute exacerbation of chronic sinusitis, sinus operation history, allergic rhinosinusitis and pathologies obstructing the nasal passage such as septal deviation or polyps were excluded from this study.

A control nasal smear study was performed on 50 voluntary

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healthy adults. On physical examination, there was no pathology narrowing or obstructing the nasal passage and their nasal mucosa was normal.

Diagnosis of AMS was based on history, physical examination, radiography and sinus punctures. In the history, symptoms related to sinusitis were questioned and major symptoms were scored as 2 points and minor ones as 1 point (Table 1). During the follow-up period, the symptoms were evaluated as present or absent.

Table 1. Scoring of AMS symptoms.

Major symptoms	Purulent nasal discharge, Postnasal discharge, cough	Each symptom 2 points
Minor symptoms	Headache,periorbital edema,facial pain,tooth pain, earache,sore throath,foul breath, increased wheeze,fever	Each symptom 1 point

Patients with Water's graphics confirming AMS with opacification and air-fluid level were found eligible for the study, but patients with mucosal thickening or cysts etc. on graphics were excluded from the study.

Maxillary sinus puncture was performed through the lower meatus after mucosal and local infiltration anesthesia. Sinus fluid was obtained under sterile conditions without sinus irrigation for culture-sensitivity tests.

Nasal smear specimens were taken on the 1st, 3rd, 7th, 14th, 21st, 28th and 56th day from the beginning of the treatment and were examined by the physician who was blinded to the study. Nasal smear was obtained by port-cotton from the middle meatus on the same side of AMS in the patients. Nasal swabs were gently spred on slides and stained with May-Grünwald-Giemsa and Haematoxilen-Eosin. Assessment of the nasal smears was performed according to the method reported by Kutluhan et al. (1997) and Jousimier-Somer et al. (1988). Each specimen was examined under a light microscope and the neutrophil count was recorded as an average number in per high-power field. As shown in Figures 1 to 5, scoring was done according to the average neutrophil number (0= 0 point, 1= 1 point, 2-5 = 2 points, 6-19= 3 points and 20-above = 4 points).

Table 2. Treatment Groups.

Groups	Treatment periods
Group 1 = 10 patients	1 week
Group 2 = 10 patients	2 weeks
Group 3 = 10 patients	3 weeks
Group 4 = 10 patients	4 weeks

Treatment groups were formed according to the treatment period (Table 2). Medical treatment consisted of one of the following antibiotics according to the culture-sensitivity results

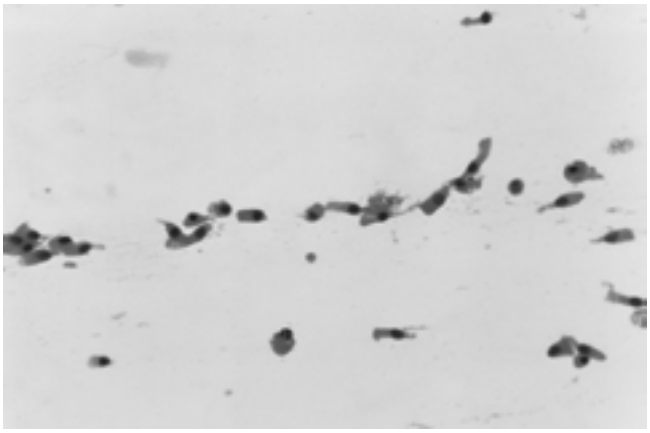

Figure 1. An example of nasal smear with 0 point showing only respiratory-type ciliated epithelial cells (Hematoxylin-eosin stain, original magnification, X 100).

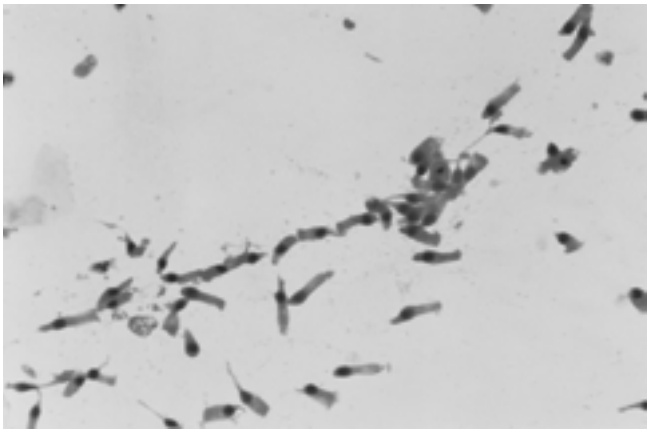

Figure 2. An example of nasal smear with 1 point showing only one neutrophil leukocyte and numerous respiratory-type ciliated epithelial cells (Hematoxylin-eosin stain, original magnification, X 100).

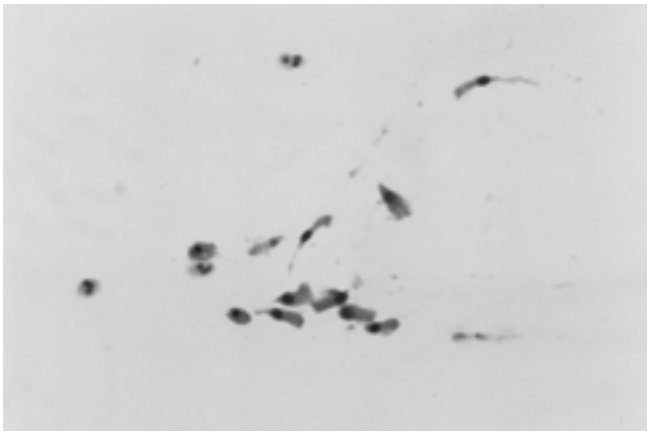

Figure 3. An example of nasal smear with 2 point showing three neutrophil leukocytes and numerous respiratory-type ciliated epithelial cells (Hematoxylin-eosin stain, original magnification, X 100).

Table 5. Average nasal smear scores of the groups during follow-up period.

Groups	Day 1	Day 3	Day 7	Day 14	Day 21	Day 28	Day 56
1	2,9±0,56	3,2±0,63	1,6±1,07	2±1,05	2,2±1,2	2,2±1,2	2,3±1,2
2	3,27±079	3,1±0,56	1,7±0,94	0,7±1,05	0,8±1,2	0,8±1,2	0,7±1,05
3	3±0,66	2,9±057	1,6±0,96	1±1,33	0,9±1,28	0,9±1,28	1,1±1,6
4	3,2±0,63	3,2±063	1,6±0,96	1±1,05	1±1,24	1±1,24	0,8±1,13
P value	0,6486	0,6267	09870	0,0562	0,0363	0,0363	0,0209

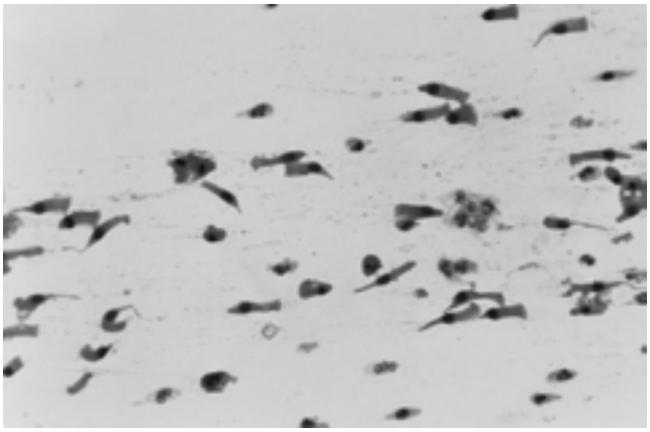

Figure 4. An example of nasal smear with 3 point showing seventeen neutrophil leukocytes and numerous respiratory-type ciliated epithelial cells (Hematoxylin-eosin stain, original magnification, X 100).

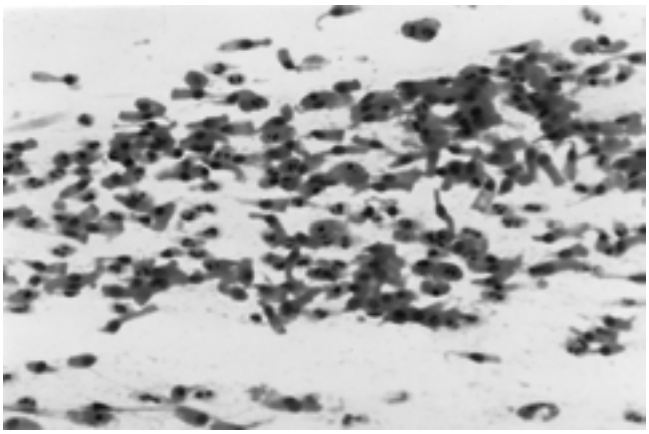

Figure 5. An example of nasal smear with 4 point showing numerous neutrophil leukocytes and respiratory-type ciliated epithelial cells (Hematoxylin-eosin stain, original magnification, X 100).

(Amoxicillin-clavulanate bid-1000 mg tablet; Ciprofloxacin-500 mg tablet; Clarithromycin-500 mg tablet and Cefuroxime axetil-250 mg tablet were given peroral (PO) twice a day), and an analgesic drug (Paracetamol) was given PO when needed. The patients were not given any topical nasal drop.

In follow-up, nasal smear findings and symptoms of the patients were recorded. During the study, differences in symptom scores and nasal smear scores among the groups were assessed statistically by the Kruskal-Wallis test. Linear correlations between symptom scores and nasal smear scores were investigated by the Spearman correlation coefficiency test: linear correlations for rs values 0-0,25: none; 0,25-0,50: weak; 0,50-0,75: strong; and >0,75: very strong or excellent.

RESULTS

Total symptom scores of the treatment groups at the time of diagnosis and during the study are shown in Table 3. There was at least one major symptom in each patient. The most common major symptom was postnasal discharge and the most common minor symptom was facial pain. No major or minor symptoms were recorded in any patient on days 7 and 14 of the treatment period. Relapse of the symptoms was noted in 5, 2, 2 and 3 patients in groups 1, 2, 3 and 4 on the 28th day, respectively. However, considering symptom scores among groups, no statistical difference was found during the follow-up period.

Table 3. The course of total symptom scores of the groups during follow-up period.

Groups	Day 1	Day 3	Day 7	Day 14	Day 21	Day 28	Day 56
1	42	23	-	-	9	24	24
2	45	20	-	-	3	7	8
3	48	18	-	-	2	5	6
4	43	25	-	-	4	8	10
P value	0,70	0,08	1	1	0,57	0,11	0,14

Isolated microorganisms from sinus puncture fluids are shown in Table 4. *S. pneumoniae* was the most frequent agent in all groups.

Table 4. Microorganisms isolated from maxillary sinus cultures.

Microorganisms	Group 1	Group 2	Group 3	Group 4
S. pneumoniae	6	4	5	4
M. catarrhalis	2	1	3	2
S. aerus	1	2	1	4
S. pyojenes	1	2	1	-

In the control group, 0 or 1 neutrophils were observed in 95 % the nasal smears and 2 or 3 neutrophils in the others. Therefore, the presence of 1 or 2 neutrophils was regarded as a normal nasal smear finding. In this study nasal smear scores 2, 3 or 4 were accepted as evidence of acute sinusitis.

In the patient groups, the smallest nasal smear score was recorded as 2.9 in group 1, while the highest score was 3.27 in group 2 at the time of diagnosis (Table 5). No statistically significant differences were found in average nasal smear scores of the groups in the first 14 days of treatment, but they were noted on days 21, 28 and 56. These differences were due to reincrease of average nasal smear score between group 1 and other groups. In the same period, no statistically significant differences were noted among groups 2, 3 and 4.

When the symptom scores (Table 3) were compared with nasal smear scores (Table 5), it was observed that a symptom resolution developed before a decrease in nasal smear scores and, relapse of the symptoms occurred 7 days after the reincrease in nasal smear scores especially as seen in group 1. According to the Spearman correlation coefficiency test, a weak correlation (rs: 0.3155) was noted between symptom scores and nasal smear scores on the first day. There were excellent linear correlations on days 21, 28 and 56 (rs values respectively: 0,8249, 0,8658 and 0,8434), but no linear correlations on days 3, 7 and 14 (Figure 6).

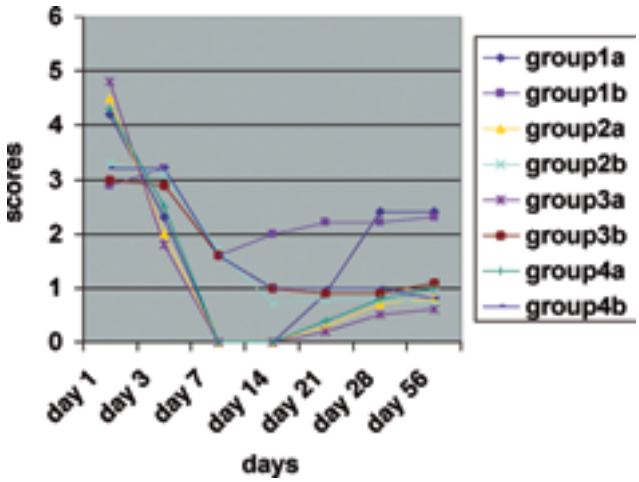

Figure 6. The correlation between average symptom scores and nasal smear scores of the patient groups. a: average symptom scores, b: average nasal smear scores.

DISCUSSION

Acute sinusitis in adults is a common community-acquired infection. Over 30 million people in the United States are diagnosed with sinusitis by their primary physicians each year (Vital and health statistics, 1994). Untreated or inadequately treated episodes of acute sinusitis may result in chronic sinusitis due to irreversible changes in the mucosal lining of the sinus. Furthermore, due to their anatomic location and rich vascular supply, sinus infections are potentially life threatening and may cause intracranial suppurative complications (Schwartz, 1994; Gwaltney, 1996). Additionally, the economic impact is particularly considerable in lost workdays. Therefore, early diagnosis and appropriate antimicrobial therapy are important for the prevention of suppurative complications.

Requirement for easily and commonly applied methods is obvious in diagnosis of acute sinusitis. Nasal smear can be used in diagnosis of sinusitis as in allergic rhinitis. In studies of general populations, eosinophilia in nasal secretion has been found in about 30% of infants and children with secretion who did not complain of any rhinitis symptoms, 30% of the eosinophilic students were symptom free, as were most of the elderly people with eosinophilia (Malmberg et al., 1985). On the other hand, Jousimier-Somer et al. (1988) have reported that neutrophilia in nasal smear has rarely been seen or not seen under normal conditions. They found abundant neutrophilia (4 points) in 92% of smears in patients with AMS. Likewise, a good correlation has been demonstrated between high leukocyte counts (>1000/mm^3) of maxillary sinus secretions and infection with high titers of bacteria (Enquist et al., 1984).

Jong et al. (1984) reported that correlated findings with occult sinusitis in sinus graphics of asthmatic children whose nasal cytology revealed 5 or greater neutrophil leucocytes. Wilson et al. (1988) have compared nasal cytology with sinus graphics in 35 children and 20 adults. There was a correlation of 79% between cytology and radiographies when the cytology revealed greater than one neutrophil; the radiographies were 90% positive when more than six neutrophils were seen. In this study, we have confirmed the absence of neutrophilia in nasal smears in healthy individuals by showing 1-2 neutrophils in nasal smears of only 5% of the control group. On the other hand, average nasal smear scores above 2 in our patient groups at the time of diagnosis supports that the increase of neutrophils in nasal smear may be a finding of acute sinusitis.

Management of acute sinusitis often includes antimicrobial therapy and appropriate adjunctive therapy to relieve the patient's symptoms. The role of antibiotherapy has been debated, because at least some recent trials reported a high rate of spontaneous cure following placebo treatment (Wald et al., 1986; Van Buckem et al., 1996). However, another study claimed that patients given penicillin V or amoxicillin improved significantly more rapidly than those given placebo (Lindboek et al., 1996). Because these studies did not specifically require bacterial identification, it is impossible to discern if the differences in clinical cure rates between antimicrobials and placebo in these trials were attributable to viral or noninfectious etiologies. However, it is not always possible to detect the microbiological agent in all suspected patients by sinus puncture. The most useful method in deciding to give antibiotics to suspected patients who have acute sinusitis is still radiological. As seen in this study, nasal smear may help in this decision. Furthermore, performing nasal smear in suspected patients might be guiding in two aspects. First, an increase in neutrophil number in nasal smear is linearly correlated with severity of inflammatory process in the sinus mucosa (Kutluhan et al., 1997; Enquist et al., 1984) and second, contri-

bution of other cells and elements that could be seen in nasal smear may lead us to differential diagnosis.

The optimum duration of antibiotic treatment in acute sinusitis is still being studied. These periods have been usually established based on clinical and radiological findings (Stefanson et al., 1998; Klapen et al., 1999; Clifford et al., 1999; Gehanno et al., 2000). Clinical cure was defined as a complete recovery with absence of all signs and symptoms. Clinical success was defined as either clinical cure or clinical improvement, i.e., there was no need for an additional follow-up treatment and clinical relapse is to return the symptoms and signs (de Bock et al., 1997). Essentially, recovery of acute sinusitis means the recovery of the sinus mucosal infective process or providing in recovery trend. Therefore, applied medicaments in acute sinusitis could remove the patient's symptoms without sinus mucosal recovery, as supported in this study. The symptom scores of the patients completely disappeared in all our treatment groups on control days 7 and 14, but nasal smear scores had not completely disappeared on the same control days (Figure 6). As a result, it was obtained that since nasal smear reflects sinus mucosal inflammation, neutrophils will be seen in nasal smears as long as inflammation persists.

It is recommended to control the patients with AMS on the 28th day of the therapy for clinical relapses (Johnson et al., 1999). In this study, a relapse of the symptoms was noted in 5, 2, 2 and 3 patients in groups 1, 2, 3 and 4 on the 28th day, respectively. On the other hand, reincreases in nasal smear scores were observed again on the 21st day. In conclusion, presence of excellent linear correlations between symptom scores and nasal smear scores on days 21, 28 and 56 revealed that symptoms are as valuable as nasal smear findings in the relapse of AMS.

In this study, although there was no statistically significant difference in nasal smear scores of the treatment groups in the first 14 days, it was found that beginning from the 21st day, a reincrease in nasal smear scores appeared in group 1. This result shows that treatment duration was insufficient in group 1. On the other hand, the absence of statistically significant differences in view of nasal smear scores among groups 2, 3 and 4 has showed that the appropriate treatment duration in AMS should be at least 14 days.

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