Prophylaxis of Rheumatic Fever

By Edward A. Mortimer, Jr., M.D., and Charles H. Rammelkamp, Jr., M.D.

GROUP A streptococcal infection initiates acute rheumatic fever; rheumatic valvular heart disease is a sequela that develops during or subsequent to the acute rheumatic episode. The mechanism by which the preceding streptococcal infection produces the arthritic and constitutional symptoms and valvular heart disease is unknown. Regardless of the mechanism involved, there is little doubt that prevention of the streptococcal infection eliminates acute rheumatic fever and presumably rheumatic heart disease in any population group. This fact has guided the management of a selected group of individuals, namely those patients who have already had 1 attack of rheumatic fever. The continuous prophylactic administration of a sulfonamide drug or penicillin is a widely practiced measure for ensuring freedom from streptococcal infections and rheumatic recurrences.

The establishment of the relationship of the streptococcal infection to acute rheumatic fever led to the development of other methods for the control of rheumatic fever, since it was logical to believe that successful treatment of the original streptococcal respiratory disease might alter the attack rate of this non-suppurative complication. Treatment with sulfonamides failed to prevent rheumatic fever in spite of the favorable influence it exerted on the natural course of the acute respiratory illness. Subsequently, penicillin was employed by Massell, Dow, and Jones for the therapy of streptococcal infections in patients who had experienced 1 or more rheumatic episodes and recurrent attacks of rheumatic fever were eliminated. Similarly, initial attacks of rheumatic fever may be prevented by successful treatment of the streptococcal illness with penicillin or other antibiotics.

On the basis of this and other information, the American Heart Association has made recommendations for the control of rheumatic fever that are summarized in table 1. Minor changes in the methods employed in prophylaxis and treatment of streptococcal infections undoubtedly will be made as experience accumulates. For example, the duration of protection afforded by various doses of benzathine penicillin has not been determined nor has the daily oral dose of penicillin prophylaxis been finally established. Recent evidence indicates that 1,200,000 units of benzathine penicillin will protect against streptococcal infections for 6 weeks and 900,000 units for 4 weeks. Likewise, oral penicillin probably should be administered in doses of 200,000 units twice daily to insure adequate prophylaxis.

It appears unlikely that major revisions in these recommendations will be made unless new data become available that invalidate previous conclusions. Recently, serious doubts have been raised as to whether successful treatment of streptococcal infections does indeed prevent valvular heart disease. In addition, some physicians have questioned the desirability of continuing prophylaxis for life in those individuals who have experienced 1 or more rheumatic attacks. It is the purpose of the present discussion to review some of the data and considerations presently available regarding these 2 aspects of the problem of rheumatic fever.

DOES TREATMENT OF THE STREPTOCOCCAL INFECTION PREVENT RHEUMATIC HEART DISEASE AS WELL AS SYMPTOMS OF ACUTE RHEUMATIC FEVER?

It is apparent from various studies that treatment of the streptococcal illness results in a decreased incidence of the clinical manifesta-
Subsequent attacks of rheumatic fever were observed in only 1 instance. In spite of the lack of controls, this appears to be a remarkably low incidence of rheumatic sequelae.

The most extensive controlled studies have been conducted among men in military populations. In 1951 Wannamaker and associates employed penicillin in 1 of 3 dosage schedules in the treatment of 1,178 patients with exudative tonsillitis and pharyngitis, and 1,162 patients served as controls, receiving no specific therapy. Within 45 days after the onset of the streptococcal infection, 2 patients who had received penicillin developed acute rheumatic fever, whereas this complication occurred in 28 of the control group.

Treatment with 1 of 2 broad spectrum antibiotics also reduced the attack rate of acute rheumatic fever, but the results were not so striking as those obtained following the use of penicillin. In a series of 1,009 patients who received chlorotetracycline, 5 developed rheumatic fever, whereas 20 of 1,035 controls incurred this complication. In a comparable study in which oxytetracycline was employed as therapy of streptococcal exudative pharyngitis, rheumatic fever occurred within 35 days in 12 of 480 untreated controls and in 5 of 506 patients who received treatment.

The results of these studies indicate beyond doubt that successful treatment of the preceding streptococcal infection decreases the frequency of acute clinical attacks of rheumatic fever. Analysis of the failures to prevent acute rheumatic fever by the treatment of the preceding streptococcal infection with 1 of the antibiotic drugs showed that any form of treatment that does not eliminate the infecting organism was not satisfactory. Thus, in those individuals with streptococcal infections whose organism was not eliminated by therapy, the attack rate of rheumatic fever was not appreciably different from that observed in patients receiving no therapy. The importance of the living streptococcus in the production of acute rheumatic fever is also emphasized by the fact that sulfadiazine, a bacteriostatic agent, does not eliminate the organism when administered to patients with streptococcal pharyngitis and does not decrease the attack rate of acute rheumatic fever. Therefore, in the evaluation of

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**Table 1.—Recommended Procedures for the Prevention of Rheumatic Fever**

<table>
<thead>
<tr>
<th>Treatment of Streptococcal Infections by One of the Following Methods</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzathine penicillin G intramuscularly</td>
<td></td>
</tr>
<tr>
<td>Children: One injection of 600,000 units</td>
<td></td>
</tr>
<tr>
<td>Adults: One injection of 600,000 to 900,000 units</td>
<td></td>
</tr>
<tr>
<td>Procaine penicillin with 2 per cent aluminum monostearate in oil intramuscularly</td>
<td></td>
</tr>
<tr>
<td>Children: One injection of 300,000 units every 3 days for 3 doses</td>
<td></td>
</tr>
<tr>
<td>Adults: One injection of 600,000 units every 3 days for 3 doses</td>
<td></td>
</tr>
<tr>
<td>Oral penicillin</td>
<td></td>
</tr>
<tr>
<td>Children: 250,000 units 3 times a day for 10 days</td>
<td></td>
</tr>
<tr>
<td>Adults: 250,000 units 3 times a day for 10 days</td>
<td></td>
</tr>
<tr>
<td>Broad spectrum antibiotics</td>
<td></td>
</tr>
<tr>
<td>Therapeutic doses for at least 10 days</td>
<td></td>
</tr>
</tbody>
</table>

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**Prevention of Streptococcal Infections in Rheumatic Individuals**

Continuous prophylaxis for life by 1 of the following methods:

- Intramuscular: 1,200,000 once a month
- Benzathine penicillin G
- Sulfadiazine: 0.5 to 1.0 Gm. once daily
- Oral penicillin: 200,000 to 250,000 units daily

*As recommended by the American Heart Association. The order of medication is the order preferred by the authors.*

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In 1953 Breese reported 1,204 streptococcal infections in 792 infants and children, all treated with penicillin or other antibiotics.
various therapeutic regimens for prevention of rheumatic fever by treatment of the preceding streptococcal infection, it becomes necessary to examine the bacteriologic results.

Primarily on the basis of the above studies the American Heart Association made recommendations for the prevention of rheumatic fever. Until evidence to the contrary is produced, it was logical to assume that prevention of the acute joint and constitutional symptoms of rheumatic fever would result in a decreased incidence of rheumatic valvular heart disease. Recently, Weinstein, Boyer, and Goldfield have produced some data that indicate that treatment of the preceding respiratory illness prevents the symptoms of acute rheumatic fever but not valvular heart disease. In their initial studies electrocardiographic abnormalities developed in patients with scarlet fever during early and late convalescence and this was considered as evidence that rheumatic carditis was not prevented by therapy. Subsequent follow-up studies confirmed this impression, since rheumatic valvular heart disease appeared in most of those patients who exhibited abnormalities and did not appear in those with normal electrocardiograms.

In Weinstein’s study 167 patients with scarlet fever were treated with penicillin. Forty of these received 800,000 units orally each day for 10 days; 127 were given 120,000 units intramuscularly daily for 10 days. During convalescence 12 patients (7.2 per cent) developed symptoms and signs suggestive of rheumatic fever and of these, 2 met the diagnostic criteria employed by Jones. The other 10 patients demonstrated electrocardiographic changes and in a few of these vague symptoms were also recorded. Seven years later 110 of the original 167 patients returned for study, including 10 of the original 12 suspected of having acute rheumatic fever. None of the 100 patients available for examination who had had no findings suggestive of rheumatic fever earlier showed findings indicative of valvular heart disease. Of the 10 patients diagnosed as possible rheumatic fever only 2 were thought to have normal hearts at this follow-up examination and 8 exhibited signs indicative of rheumatic valvular heart disease.

The fact that valvular heart disease developed in those patients exhibiting electrocardiographic changes during the acute streptococcal infection and early convalescence led the authors to suggest that treatment of the original streptococcal infection prevented the acute clinical manifestations of rheumatic fever but not valvular deformities. This situation might be considered analogous to the effects of ACTH and cortisone, which suppress the clinical manifestations but not valvular heart disease when administered during an attack of acute rheumatic fever. If these observations of Weinstein are confirmed, the failure to prevent valvular deformities by treatment of the streptococcal infection with penicillin suggests that the mechanisms of production of joint disease and heart disease are different. Furthermore, if treatment of the streptococcal infection does not reduce the incidence of valvular heart disease, other methods of accomplishing this goal should be pursued vigorously. Although final answers are not yet available, certain data would indicate that adequate treatment of the acute respiratory infection may alter the incidence of rheumatic carditis.

There are a number of studies of electrocardiographic changes subsequent to scarlet fever and streptococcal pharyngitis. Faulkner, Place, and Ohler observed changes in the T wave in leads I or II or prolongation of the P-R interval to 0.20 sec. or longer in 6 per cent of 171 patients with scarlet fever who received no specific treatment. Roelsen found a prolonged P-R interval of 0.20 sec. or more in 16 per cent of 108 patients with scarlet fever and arthralgia and in 4 per cent of 99 scarlet fever patients without arthralgia. In these 2 studies no specific antibacterial treatment was employed. Watson, Rothbard, and Swift studied 110 adults with scarlet fever who received either sulfadiazine or no specific therapy. Twenty-two or 20 per cent showed electrocardiographic abnormalities at some time during the illness. Fifteen of the 22 patients exhibited an increase of the P-R interval of 0.04 sec. or more. Seven showed inverted T waves in leads I or II. In this total group of 22 patients there were 6 definite and 2 probable
cases of active rheumatic fever. Rantz, Spink, and Boisvert\textsuperscript{19} performed serial electrocardiograms on 185 of 410 soldiers with streptococcal pharyngitis of whom 14.9 per cent received small amounts of penicillin and the remainder sulfonamides or only symptomatic therapy. Of the 185 patients studied 31 (16.7 per cent) showed definite prolongation of the P-R interval or flat or inverted T waves in leads I and II. Nine of these 31 patients were thought to have rheumatic fever.

In 1952, Levander-Lindgren\textsuperscript{20} described the results of electrocardiographic studies on 2,831 children and adults with scarlet fever. Most of the patients were treated with penicillin and about 20 per cent served as controls. T-wave abnormalities or P-R interval changes occurred in 3.3 per cent. This low incidence of abnormalities may have been influenced by the infrequency with which tracings were obtained compared to other series. Ninety-six of the 110 patients with all types of electrocardiographic changes were examined 1 to 5 years later and of these only 1 patient showed auscultatory evidence of valvular heart disease. This observation does not confirm the results reported by Weinstein.\textsuperscript{12}

These several studies demonstrate that electrocardiographic changes of the type described by Weinstein, Bachrach, and Boyer\textsuperscript{13} occur fairly frequently during convalescence from streptococcal infections. They have been noted in other acute infections and all of them are not necessarily indicative of rheumatic carditis.\textsuperscript{21}

The question whether penicillin treatment of streptococcal infections alters the frequency of these changes may be answered by 2 studies. Levander-Lindgren\textsuperscript{20} stated that penicillin seemed to decrease the frequency of severe electrocardiographic changes in adults but otherwise had little or no effect. However, review of her data, excluding from consideration a group of patients whose therapy was withheld for 5 days, shows that changes occurred in 4.9 per cent of controls as compared to 3.2 per cent in the cases receiving penicillin. A more striking difference was observed by Hahn\textsuperscript{22} in studies in a military population. Abnormalities, including prolongation of the P-R interval to 0.21 sec. or by an increment of at least 0.04 sec., inversion of the T wave in leads I or II, and prolongation of the Q-T interval occurred in 11.2 per cent of 566 untreated controls subsequent to streptococcal pharyngitis. Treatment with penicillin or broad-spectrum antibiotics in 724 patients was associated with an incidence of these abnormalities of only 5.2 per cent, a highly significant difference. If the electrocardiographic changes are specific and indicate rheumatic carditis, the data obtained by Hahn\textsuperscript{22} would suggest that the incidence of specific carditis was decreased by treatment. It is also possible that treatment prevented only nonspecific changes rather than the abnormalities associated with rheumatic carditis.

A remarkable finding in the report of Weinstein\textsuperscript{20} is the very high incidence of valvular heart disease found 7 years later in the 10 patients with electrocardiographic abnormalities. That 8 of these 10 showed evidence of rheumatic heart disease at follow-up examination in contrast to none of those whose tracings 7 years earlier were normal suggests that these electrocardiographic changes presage the development of valvular heart disease with remarkable accuracy and that their absence is a reassuring prognostic sign. It is difficult to reconcile these results with studies on patients with symptoms of acute rheumatic fever. For example, Stolzer, Houser, and Clark\textsuperscript{23} studied 138 patients who had daily electrocardiograms for the first 3 weeks and every other day for the next 6 weeks. All patients were maintained on prophylaxis and examined 14 months later for evidence of valvular heart disease. Approximately 50 per cent of the group showed abnormal prolongation of A-V conduction during the course of acute rheumatic fever, and of this group only 38 per cent were found to exhibit valvular heart disease 14 months later. In contrast, 22 per cent of those patients who showed no abnormal atrioventricular conduction exhibited valvular heart disease at the time of the final examination. Thus, in this study abnormal prolongation of the P-R interval did not necessarily foretell the development of valvular heart disease and valvular abnormalities developed frequently in the absence of prolongation of the conduction time.
As mentioned above, in order to decrease the attack rate of rheumatic fever by treatment of the preceding respiratory infection, it is probably necessary to eradicate the group A streptococcus. In the series of Weinstein\textsuperscript{22} 33 per cent of all patients with scarlet fever are known to have developed a bacteriologic relapse or reinfection after cessation of therapy with penicillin. It is not clear from their reports how many of the 12 patients suspected of having rheumatic fever incurred such relapses. However, upon re-examination of the data\textsuperscript{24} cultures from 8 patients showed no group A streptococci at the time rheumatic fever was first suspected or during the rheumatic episode. In 1 instance streptococci reappeared in the pharynx prior to the development of rheumatic symptoms, and from 3 individuals streptococci were isolated following the first sign of rheumatic fever. Thus, in this small group of patients streptococci were isolated from the pharynx no more frequently in the suspected rheumatic group than in the entire series.

Final answers to the disturbing questions raised by the study of Weinstein\textsuperscript{12} are unavailable at present. There is no doubt that treatment of the preceding streptococcal infection decreases the incidence of rheumatic fever providing the treatment is adequate to eliminate the organism. It has also been shown by Hahn\textsuperscript{22} that such treatment prevents, in large part, the electrocardiographic changes frequently observed following streptococcal infections. However, the answer to the question whether treatment of the streptococcal infection prevents rheumatic valvular deformities must await information that can be obtained only from a controlled study. Until such information is available, it would seem advisable to continue to treat acute streptococcal diseases with therapy known to eliminate the organism in the majority of instances.

**How Long Should Prophylaxis Be Maintained in the Patient Who has Had Rheumatic Fever?**

In order to plan a rational method of management of the patient who has experienced rheumatic fever the physician should be acquainted with certain epidemiologic features of streptococcal infections and rheumatic fever. Group A streptococci are maintained in nature in the upper respiratory tract of man. The most dangerous source of infections is the carrier who has recently acquired the organism.\textsuperscript{25} Since streptococcal infections occur frequently in the young, school-age child, any situation that places the individual in contact with children increases the risk of infection. The organism is transferred to the susceptible host by intimate contact and not by droplet nuclei, contaminated dust, bedding, and other articles.\textsuperscript{25}

Although adults apparently acquire fewer streptococcal infections than children, it is probably a fallacy to believe that this is due to acquired resistance. Immunity in man is type-specific and relatively long enduring.\textsuperscript{25, 26} Since most adults probably have had experience with only a few serologic types during childhood, they should become infected if adequately exposed to a carrier harboring a new type of streptococcus. Experience in military populations shows that young adults are very susceptible to these infections when assigned to an installation experiencing an epidemic.

Although type-specific immunity to streptococcal infections may play a minor role in the decreased incidence of both initial and recurrent attacks of rheumatic fever in older age groups, the major factor is most likely the lack of effective contacts with carriers of the organism. Another factor that may contribute to the low rates of initial attacks of rheumatic fever in the adult is decreased susceptibility to rheumatic fever following a streptococcal infection.\textsuperscript{12} Although the data are meager, available information indicates that the rates are not influenced by age,\textsuperscript{*} once a streptococcal infection develops.\textsuperscript{27} The situation in relation to the risk of recurrence of rheumatic activity as age progresses is poorly defined, but it is generally agreed that 1 attack confers a marked increase in susceptibility.

The reported rates of recurrence from 3 studies are shown in table 2. Although the figures vary among the 3 studies, it is apparent

\* Attack rates of rheumatic fever following the first experience with the organism are not available.
that the number of recurrences diminished with succeeding years. Nonetheless, the data of Bland and Jones show a relatively high rate of recurrence 10 to 20 years after the original bout of rheumatic fever, indicating that a considerable risk still obtains in early adult life. Leonard found that annual recurrence rates depended on age at onset and varied between 10 and 23 per cent 5 years after the initial attack and between 5 and 10 per cent 9 years after the first attack.

In an extensive study comprising 3,129 patients with approximately 6,000 recurrences, Cohn and Lingg in 1943 published information regarding yearly recurrence rates. The recurrence rates may be somewhat high in this study, since patients with ill-defined "subacute activity" were included. Recurrent attacks fell gradually from rates ranging between 10 and 40 per cent initially, depending on age, to rates of between 5 and 19 per cent per year by early adult life and then persisted at this level. The group whose initial attack occurred prior to 5 years of age was an exception to this; 15 years later recurrences still occurred yearly in 15 to 25 per cent of this group. The results of these studies indicate that risks of recurrences are high as late as 15 to 20 years after the original attack, but they do not define the effect of freedom from activity on the susceptibility to recurrence. Here again, the available data are few.

Wilson and Lubschez, employing a life table technic, studied 499 rheumatic patients who experienced a total of 817 recurrences. Thirty-one per cent of the original group did not experience a recurrence. The risk for a major recurrence (arthritis, chorea, or active carditis, alone or in combination) was 20.6 per cent in the first year following an attack, 10.7 per cent following 1 year of freedom from activity, and 6.6 per cent following 2 or more years of freedom. The recurrence rate in children was higher than in young adults. The annual recurrence rate for patients between 17 and 25 years of age was 3.7 per cent, a seemingly low risk; however, over a 10-year period the patient statistically had 1 chance in 3 of developing a recurrence.

Some information is available concerning the time that first recurrences of rheumatic fever occur. Comparison of the data from 2 studies shows considerable differences in the time the first recurrences developed (table 3). These differences may be due to multiple factors, including length of observation of the rheumatic populations, age, and number of streptococcal infections. However, the important fact is that recurrences of rheumatic

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Years after initial attack</th>
<th>1-5 (%)</th>
<th>6-10 (%)</th>
<th>11-15 (%)</th>
<th>16-20 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaiser</td>
<td>1934</td>
<td>89</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ash</td>
<td>1948</td>
<td>63</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bland and Jones</td>
<td>1951</td>
<td>76</td>
<td>57</td>
<td>30</td>
<td>-</td>
<td>7</td>
</tr>
</tbody>
</table>

TABLE 2.—Per cent of Patients Developing Recurrences at Five-Year Intervals after the Original Attack

The following table shows the intervals between the first attack and first recurrence, the series of Mackie and the series of Fischel.

<table>
<thead>
<tr>
<th>Interval in years between first attack and first recurrence</th>
<th>Series of Mackie</th>
<th>Series of Fischel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Per cent</td>
<td>Number</td>
</tr>
<tr>
<td>0-1</td>
<td>34</td>
<td>24</td>
</tr>
<tr>
<td>1-2</td>
<td>22</td>
<td>15</td>
</tr>
<tr>
<td>2-3</td>
<td>19</td>
<td>13</td>
</tr>
<tr>
<td>3-4</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>4 or more</td>
<td>62</td>
<td>43</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>100</td>
</tr>
</tbody>
</table>

TABLE 3.—Interval Between Initial Attack of Rheumatic Fever and First Recurrence in Patients who Experienced at Least One Recurrence

The following table shows the major rheumatic recurrences developing in patients who have experienced four or more years of freedom from activity.

<table>
<thead>
<tr>
<th>Year of observation after last rheumatic episode</th>
<th>Number of patients observed</th>
<th>Number of recurrences</th>
<th>Per cent recurrences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fifth</td>
<td>74</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>Sixth</td>
<td>60</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Seventh</td>
<td>48</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Eighth</td>
<td>40</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Ninth</td>
<td>29</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tenth</td>
<td>20</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Eleventh</td>
<td>13</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Twelfth</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>35</td>
<td>47</td>
</tr>
</tbody>
</table>

* Activity is defined as chorea, objective arthritis, carditis, or nodules.
fever do occur after long periods of freedom from activity.

An earlier study of Wilson, Lingg, and Croxford supports the concept that the risk of recurrence after a number of years of freedom is high. Data were presented regarding each of 412 rheumatic subjects followed for varying periods of time after their original attacks. There were 72 patients who experienced a total of 74 periods of more than 4 years of freedom from major activity. The recurrences that developed in these patients subsequent to 4 years of freedom are shown by year of observation in table 4. It is again evident that recurrences may occur many years after the original attack in spite of long intervals without rheumatic activity.

It is obvious that a rational method of management of the rheumatic patient cannot be established unless susceptibility to recurrence can be defined in relation to other factors such as age, period of freedom from activity, and the role of streptococcal infections. As mentioned previously, the decreased incidence of streptococcal infections in the adult may account for the decreased occurrence of rheumatic attacks recorded in the studies reviewed. Some information concerning the susceptibility to recurrence following an observed streptococcal infection at age 17 to 25 was obtained from an analysis of 216 patients admitted to a military hospital. A total of 216 patients were seen who had a respiratory illness and who exhibited group A streptococci in the cultures of the oropharynx. Seventy-seven of these 216 patients received no specific treatment and were observed for signs of rheumatic activity for a minimum of 3 weeks from onset of their streptococcal infection. A diagnostic increase in the antistreptolysin titer was demonstrated in the convalescent serum as compared to the titer of the serum obtained at the onset of the respiratory illness in 71 per cent of the patients studied. Pharyngeal or tonsillar exudate was observed in 45 of the 77 patients. The attack rate for rheumatic fever in this group is recorded in table 5 according to the number of years that had elapsed since the last rheumatic episode.

Rheumatic fever, according to criteria for diagnosis previously defined, developed in a total of 14 or 18 per cent of the 77 patients observed during and following a streptococcal infection. The attack rate according to the number of years that had elapsed since the last rheumatic episode was 27, 22, and 12 per cent for less than 5, 5 to 9, and 10 or more years of freedom, respectively. Although the total number of cases studied was small, it is apparent that susceptibility to a recurrence following a streptococcal infection did not decrease greatly as the period of freedom from activity increased. Certainly, one should not discontinue the prophylactic regimen just because a recurrence had not been observed for a period of 5 or 10 years.

It has been suggested that in the adult protection from recurrences might be obtained by treatment of the streptococcal infection. The data presented in table 6 show that reliance on this method is not justified. In this study, 139 patients with a past history of rheumatic fever received treatment for the respiratory illness with antibiotics and were followed for signs of recurrences. All these patients exhibited exudative tonsillitis or pharyngitis and cul-

<table>
<thead>
<tr>
<th>Years since last attack of rheumatic fever</th>
<th>Number of infections</th>
<th>Recurrence of rheumatic fever</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Definite</td>
<td>Possible</td>
</tr>
<tr>
<td></td>
<td>Number</td>
<td>Per cent</td>
</tr>
<tr>
<td>0-4</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>5-9</td>
<td>32</td>
<td>6</td>
</tr>
<tr>
<td>10 or more</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>Unknown</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>77</td>
<td>10</td>
</tr>
</tbody>
</table>

* No specific therapy was administered for the respiratory illness.

* It is possible that freedom from experience with the group A streptococcus afforded by prophylaxis for a period of 5 or more years may alter the attack rate after a proved streptococcal infection, but no data are available for analysis.

* The authors are indebted to the professional staff of the Streptococcal Disease Laboratory for the collection of these data.
turers showed group A streptococci. The attack rate in this group was 3.6 per cent, but an additional 8 per cent showed some signs or symptoms of a recurrent attack. Since many streptococcal infections are inapparent, it is obvious that individuals such as those included in table 5 should be under continuous prophylaxis.

In summary, rheumatic recurrences occur in adult life in spite of freedom from activity for many years and the risk of recurrent activity in adult life following a streptococcal infection is high. Therefore, the risk of a recurrent attack of acute rheumatic fever in adults depends primarily on effective contacts with a carrier of the group A streptococcus. Thus, estimation of the risk of recurrence of rheumatic fever is an individual problem and the decision as to how long prophylaxis should be continued must be based on many factors. In the opinion of the authors, it is mandatory to continue prophylaxis as long as the patient is in school or serving in the armed services. Likewise, the adult, especially the parent, who is exposed to children should be protected. Those whose occupations demand intimate exposure to many people undoubtedly experience an increased risk. In contrast, a chauffeur-driven executive who is exposed to few people, other than his secretary and other chauffeur-driven executives, has less opportunity to contract infection. All these variable and individual factors must be considered by the physician in making the decision as to how long prophylaxis should be continued in an individual patient. It is not sufficient to rely on antibiotic treatment of a streptococcal infection, since many are inapparent or cause few symptoms and therapy does not prevent all recurrences. In addition, there is still some doubt whether therapy of the respiratory infection prevents cardiac damage. Therefore, prophylaxis should be maintained indefinitely except in those few individuals in whom the risk of contracting a streptococcal infection is negligible.

REFERENCES


6 Streptococcal Disease Laboratory: Unpublished observations.


22 Hahn, E. O.: To be published.


24 Weinstein, L.: Personal communication.


Prophylaxis of Rheumatic Fever
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Circulation. 1956;14:1144-1152
doi: 10.1161/01.CIR.14.6.1144

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
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