Oral Famciclovir for the Suppression of Recurrent Genital Herpes
A Randomized Controlled Trial

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**Context.**—Recurrent genital herpes simplex virus (HSV) may be treated episodically, but this may not be sufficient for patients with frequent recurrences.

**Objective.**—To determine the efficacy and safety of famciclovir in the suppression of recurrent genital HSV infection.

**Design.**—A randomized, double-blind, placebo-controlled, parallel-group study.

**Setting.**—Thirty university, hospital, or private outpatient referral centers in Canada and Europe.

**Patients.**—A total of 455 patients (223 men, 232 women) aged 18 years or older with a history of 6 or more episodes of genital herpes during 12 of the most recent 24 months, in the absence of suppressive therapy, received study medication.

**Intervention.**—Oral famciclovir, 125 mg or 250 mg 3 times daily or 250 mg twice daily, or placebo for 52 weeks.

**Main Outcome Measures.**—Time to the first recurrence of genital HSV infection; the proportion of patients remaining free of HSV recurrence at 6 months; frequency of adverse events.

**Results.**—In an intent-to-treat analysis, famciclovir significantly delayed the time to the first recurrence of genital herpes at all dose regimens (hazard ratios, 2.9-3.3; \( P < .001 \)); median time to recurrence for famciclovir recipients was 222 to 336 days compared with 47 days for placebo recipients. The proportion of patients remaining free of HSV recurrence was approximately 3 times higher in famciclovir recipients (79%-86%) than in placebo recipients (27%) at 6 months (relative risks, 2.9-3.1; \( P < .001 \)); efficacy was maintained at 12 months. Famciclovir was well tolerated with an adverse experience profile comparable to placebo.

**Conclusions.**—Oral famciclovir (125 mg or 250 mg 3 times daily or 250 mg twice daily) is an effective, well-tolerated treatment for the suppression of genital HSV infection in patients with frequent recurrences.

GENITAL HERPES simplex virus (HSV) infection is one of the most common sexually transmitted diseases. Serologic studies using Western blot have demonstrated HSV-2 prevalence of approximately 22% in adults in the United States, 7% to 28% among different populations in Europe, and 20% to 40% in selected countries in Africa. Symptomatic recurrent infection occurs in the majority of patients who develop symptomatic primary HSV-2 infection, with almost half of these patients experiencing at least 6 recurrences annually. Recurrent lesions may be painful or pruritic, and the psychological consequences of the disease, particularly the fear of transmitting the virus to others, may be severe and debilitating.

See also p 928.

Recurrent genital herpes can be successfully managed with episodic antiviral treatment in many patients. Acyclovir has been available for a number of years, and more recently, valaciclovir hydrochloride and famciclovir have been approved for use in the acute treatment of recurrent genital herpes. However, for patients with frequent symptomatic recurrences, such management may not be considered sufficient, and preventive treatment to suppress recurrences may provide more benefit than acute treatment.

Famciclovir is the oral form of penciclovir, a novel nucleoside analog that...
METHODS
Study Sites

The study was conducted at 30 university, hospital, or private referral centers located in Belgium (2 sites), Canada (9 sites), France (12 sites), Iceland (1 site), Sweden (1 site), and the United Kingdom (5 sites). The protocol and statement of informed consent were approved by an institutional review board (or ethics committee) prior to each center's initiation.

Study Population

Otherwise healthy male or female patients, aged 18 years or older, with a history of recurrent genital herpes, confirmed by serology, culture, or both, were eligible for inclusion. Written informed consent was obtained from each patient prior to entry into the study.

Patients who had not been treated with suppressive acyclovir in the year prior to study entry were eligible for inclusion if they had experienced 6 or more recurrences in the preceding 12 months. Patients who had been treated with suppressive acyclovir in the preceding 12 months were eligible if they had a history of 6 or more episodes during any 12-month period in the 2 years prior to study entry while not receiving suppressive acyclovir.

Patients were excluded if they were pregnant or breast-feeding, were immunocompromised, or had received antiviral therapy during the previous 14 days.

Study Design

The study was double blind and placebo controlled. Eligible patients were sequentially allocated a unique patient number determined by the investigator or elicited from the patient prior to entry into the study. The study consisted of two phases: a double-blind, placebo-controlled phase (52 weeks) and a single-blind, open-label phase (52 weeks).

Adverse experiences were identified by the investigator or elicited from the patient in response to the question, "Have you felt different in any way since starting the treatment or since your last assessment?"

Because patients who were experiencing confirmed recurrences were given the option of withdrawing from the study, the treatment was stopped. The patient, the investigator, and the sponsor personnel directly involved in monitoring the study or reviewing the data had no knowledge of what treatment had been allocated until the data were unblinded and the data were analyzed.

The medication code for a particular patient was only to be broken in the event of a serious adverse experience that the investigator felt could not be adequately treated without knowing the identity of the patient. The treatment code was kept intact and was not broken for any patient during this study.

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that a patient participated in the double-blind phase of the study. Thus, to compare the incidences of adverse events between famciclovir and placebo groups in a consistent and unbiased fashion, data from those patients receiving long-term suppressive therapy (>10 months of double-blind study medication) have been summarized.

At each visit, blood samples were taken for measurement of hematologic and clinical chemistry parameters; urinalysis was also performed.

**Sample Size**

A sample size of 73 patients per treatment group was required to detect a 30% difference compared with placebo in the proportion of patients who remained free of HSV recurrence for at least 6 months. This assumed at least 90% power and testing at the 1.67% significance level (using the Bonferroni adjustment) to ensure that the type I error did not exceed 5%. With 73 patients per group, the study also had 90% power to detect a ratio of 1:1.35 for the median time to the first recurrence following the start of study medication.

A target enrollment of approximately 120 patients per group was set to provide 73 patients per group with evaluable data.

### Statistical Methods

Statistical analyses were based on data recorded during double-blind treatment only. All analyses were performed on an intent-to-treat population (i.e., those patients who were randomized to and received at least 1 dose of study medication). Statistical tests were 2 sided, and 3 pairwise comparisons (i.e., each active group vs placebo) were made.

The primary efficacy parameters were the time to the first recurrence after the start of study medication and the proportions of patients who remained free of HSV recurrences (culture confirmed) for at least 6 months after the start of study medication. The proportions of patients who remained free of HSV recurrences for at least 12 months after the start of study medication were evaluated as a secondary efficacy parameter. In addition, the median number of recurrences per year was evaluated.

The times to first recurrence were analyzed using the Cox proportional hazards regression model stratified by center; 95% confidence intervals for the hazard ratio (famciclovir:placebo) and median times were also presented. The comparisons of the proportions of patients free of HSV recurrence were summarized by relative risks (famciclovir:placebo) and analyzed using the Cochran-Mantel-Haenszel test stratified by center. The median numbers of recurrences were expressed as yearly recurrence rates and analyzed using the Wilcoxon rank sum test, stratifying by investigational center.

All patients who received at least 1 dose of double-blind study medication were included in the analyses of time to first event and frequency of events. Recurrence-free proportions were based on the population known either to have experienced at least 1 recurrence or to have been recurrence free during the entire reference time interval.

Clinical laboratory results were evaluated by calculating mean differences from baseline and by identifying laboratory values of potential clinical concern (values that had changed from baseline by more than a specified amount and were outside the sponsor-defined extended normal range).

### RESULTS

A total of 457 patients were randomized to the study (Figure 1); 2 patients...
did not take any study medication; thus, the 455 patients who received double-blind study medication constituted the intent-to-treat population. A total of 223 patients were male (42%-55% in each treatment group), and the mean age ranged from 35 to 38 years (Table 1).

Between 92% and 96% of patients in each group had documented laboratory confirmation of their recurrent genital herpes at enrollment; between 69% and 77% of patients had their infection confirmed by culture and between 22% and 28% by serology. The mean duration of genital herpes was approximately 7 years, and 405 (85%) of the 455 patients had experienced at least 10 recurrences in the 2 years prior to study entry. Sixty-eight patients (15%) had received suppressive therapy with acyclovir in the previous 12 months, and 177 patients (40%) had received episodic acyclovir treatment.

A total of 218 patients withdrew from the study while receiving double-blind medication (Figure 1). The withdrawal rate for placebo recipients (88 [77%] of 114) was approximately double the rate overall for famciclovir recipients (130 [38%] of 341). Furthermore, the proportion of patients withdrawing due to lack of efficacy in the placebo group (63 [55%] of 114) was approximately 3-fold higher than the proportion in the famciclovir groups (56 [16%] of 341). The proportions of patients who withdrew while still free of HSV recurrence were similar in each treatment group (22%-31% in the famciclovir groups, 23% in the placebo group). Other reasons for withdrawal included adverse events, lack of compliance, protocol violations, and loss to follow-up (Figure 1).

The majority of patients (more than 92% in each treatment group) were compliant (≥80% of patients) with double-blind medication.

Efficacy Results

The time to the first recurrence (Table 2) was significantly prolonged for patients who received famciclovir (hazard ratios, 2.9-3.3; P<.001). The median time to the first recurrence was more than 7 months for the lowest-dose regimen of famciclovir (125 mg 3 times daily) and more than 10 months for the famciclovir 250 mg twice-daily or 250 mg 3-times-daily regimens compared with approximately 7 weeks for placebo recipients.

The proportion of patients remaining free of HSV recurrence was significantly higher for famciclovir recipients (Figure 2), with approximately 3 times more famciclovir recipients (125 mg 3 times daily, 69 [81%] of 85; 250 mg twice daily, 81 [79%] of 102; 250 mg 3 times daily, 74 [86%] of 86) than placebo recipients (25 [27%] of 91) remaining free of HSV recurrences at 6 months (relative risk, 2.9-3.1; P<.001). This difference was maintained at 12 months; again, approximately 3 times more famciclovir recipients (125 mg 3 times daily, 55 [71%] of 77; 250 mg twice daily, 65 [72%] of 90; 250 mg 3 times daily, 65 [80%] of 81) than placebo recipients (19 [22%] of 88) remained free of HSV recurrences (relative risk, 3.3-3.6; P<.001).

The median number of patient-reported recurrences per year ranged from 1 to 1.8 episodes for famciclovir recipients compared with 5.1 episodes for placebo recipients. The median number of investigator-reported recurrences per year ranged from 0 to 1.0 episode for famciclovir recipients compared with 4.4 episodes for placebo recipients (Table 3). These differences were statistically significant for all 3 famciclovir groups (P<.001).

For both of the primary efficacy variables, the 3 famciclovir regimens were comparable; treatment with famciclovir, 250 mg twice daily, 125 mg 3 times daily, and 250 mg 3 times daily had similar efficacy. There was no difference in efficacy for either male or female patients (data not shown).
Safety Results

Adverse Experiences.—Famciclovir was well tolerated during both the double-blind and open-label phases of the study, with an adverse experience profile that was comparable with placebo. The most common events occurring in the double-blind phase for patients receiving either famciclovir or placebo for at least 10 months were headache, viral infection (influenza, flulike symptoms, cold symptoms), and upper respiratory tract infection (Table 4).

Only 20 patients had adverse experiences classified as “serious” during double-blind treatment; 5 (4.5%), 3 (2.6%), and 7 (6.2%) in the famciclovir, 125 mg 3 times daily, 250 mg twice daily, and 250 mg 3 times daily, groups, respectively, and 5 (4.4%) in the placebo group. Only 2 patients experienced serious events that were considered by the investigator to be possibly related to study medication, and no patients experienced serious events considered to be related to study medication. The serious events considered to be possibly related were as follows: 1 patient in the famciclovir, 125 mg 3 times daily, group had elevated levels of bilirubin and lipase after 10 months of treatment, which resolved on therapy after 7 days and remained normal for the rest of the study; 1 patient in the placebo group developed sepsis approximately 3 weeks after treatment (clinical pancreatitis was not reported); study medication (placebo) was withdrawn, and the increased enzyme levels resolved 6 days later.

Laboratory Tests.—While there were isolated differences in laboratory parameters between treatment groups, no consistent pattern or dose response could be identified. In general, the incidence of laboratory abnormalities was comparable between the 3 famciclovir groups and the placebo group.

COMMENT

The objective of this study was to evaluate clearly the efficacy and safety of oral famciclovir in the suppression of recurrent genital herpes. In many patients, recurrent genital herpes can be successfully managed with episodic treatment; however, such management may not be considered sufficient for patients with frequent symptomatic recurrences. To illustrate this, when patients with a history of 6 or more episodes of genital herpes per year were offered a choice of either suppressive or episodic therapy after completing a 1-year study with acyclovir, 89% of patients opted for suppressive therapy.

The results from the current study clearly demonstrate yearlong treatment with famciclovir to be effective in the suppression of lesional episodes of genital herpes at all 3 dose regimens examined (125 mg 3 times daily, 250 mg twice daily, and 250 mg 3 times daily). The time to the first genital herpes outbreak was approximately 3 times longer for famciclovir recipients than for placebo recipients (hazard ratios, 2.9-3.3; P < .001; the time differences generally equate to approximately 9 months’ delay compared with placebo). Similarly, approximately 80% of famciclovir recipients remained free of HSV recurrences at 6 months compared with only 27% of placebo recipients. This difference was sustained at 12 months with approximately 75% of famciclovir recipients remaining free of HSV recurrences compared with only 22% of placebo recipients. In addition, famciclovir-treated patients experienced approximately 80% fewer recurrences per year than placebo recipients.

It is not appropriate to make direct comparisons between the results obtained in our study and those obtained in trials of suppressive acyclovir that were initiated before the licensure of oral acyclovir and widespread use of suppressive therapy; the patient populations involved in these studies are likely to be different. Nevertheless, studies have demonstrated that acyclovir, at a dose of 400 mg twice daily or 200 mg 3 to 5 times daily, is effective and safe when used as suppressive therapy for recurrent genital herpes for up to 10 years in immunocompetent patients.6,13,15-22 In 1-year studies, approximately 45% of patients receiving acyclovir at a dose of 400 mg twice daily remained recurrence free for 12 months compared with fewer than 10% of placebo recipients.19,22 Acyclovir recipients experienced a marked decrease in the number of recurrences per year, with no emergence of toxic effects over time.6

No significant changes in resistance patterns in acyclovir recipients have been detected even after long-term suppressive therapy; the prevalence of acyclovir-resistant HSV isolates in immunocompetent patients is low (typically around 0.3% of isolates).23 Similarly, no resistant virus was detected in any virus isolates obtained from famciclovir-treated patients in the current study; 1 resistant isolate was isolated from a patient receiving placebo. To date, no treatment-related HSV resistance has been detected in virus isolates from any clinical trial with famciclovir or penciclovir (R. Sarisky, MD, Smith-Kline Beecham, oral communication, May 25, 1998).

Famciclovir, 250 mg given twice daily, was found to be of similar efficacy to 3-times-daily regimens of famciclovir and provides convenience advantages that are particularly important for the long-term management of recurrent genital herpes. It has previously been demonstrated in women that the same total daily dose of famciclovir (500 mg) given once

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<th>Table 3.—Lesional Episodes per Year by Treatment Group</th>
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<td>Treatment Group</td>
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<tr>
<td>Famciclovir, 125 mg 3 Times Daily (n = 69)</td>
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<td>Famciclovir, 250 mg Twice Daily (n = 81)</td>
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<tr>
<td>Famciclovir, 250 mg 3 Times Daily (n = 76)</td>
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<td>Placebo* (n = 30)</td>
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<th>Table 4.—Most Frequently Occurring Adverse Experiences in Patients Receiving Long-Term Treatment by Treatment Group*</th>
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<td>Adverse Experience</td>
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<tr>
<td>Famiclovir, 125 mg 3 Times Daily (n = 69)</td>
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daily was clearly less effective than a twice-daily regimen.13 These data are consistent with the results of a dose-ranging study that investigated a number of different doses and dosing frequencies of suppressive oral acyclovir therapy, which suggest that twice-daily or 3-times-daily regimens of acyclovir may be more effective than once-daily treatment using equal or higher cumulative daily doses.14 To further support this, recent data with valacyclovir have also shown that a twice-daily regimen was more effective than a once-daily regimen in the suppression of frequently recurring genital herpes.24

All regimens of foscarnet were well tolerated. No differences were observed in the frequency and severity of clinical adverse experiences between foscarnet and placebo recipients, and no evidence was seen of hematologic, renal, or hepatotoxic effects in any of the foscarnet groups. The safety of oral foscarnet has already been established for the acute treatment of genital herpes infections.11,12

and our study confirms that long-term treatment with foscarnet is well tolerated with a safety profile comparable with placebo.

In summary, foscarnet at a dose of 250 mg twice daily provides a convenient, effective, and well-tolerated regimen for patients with recurrent genital herpes. Patients receiving foscarnet at a dose of 250 mg twice daily remained free of HSV recurrence for a median of 11 months and reported 80% fewer recurrences per year when compared with placebo recipients. For patients with frequent recurrences, suppressive therapy with foscarnet provides a potent and effective therapy, enabling patients to remain free from pain and discomfort and to regain a better quality of life.

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