ABSTRACT The occurrence of fever (daily maximal temperature \( \geq 38^\circ C \)) was analyzed in 123 patients after open-heart operation. A statistical difference was found in the incidence of fever after the third postoperative day between patients without infection and patients with bacteremia, wound infection, or pneumonia. Fever after the third day should prompt a diligent search for deep-seated infection.

It is well documented that a febrile response is common after open-heart operation [1-6]. Also, some researchers concluded that the incidence of fever was not statistically different between infected and uninfected patients after cardiac valve operation [1]. Because of the importance of early diagnosis of serious postoperative infection, this study was undertaken to evaluate fever as a clinical indicator of infection after cardiac operation.

Material and Methods
As part of a study comparing clindamycin and cephalothin for antibiotic prophylaxis during cardiac operation, 263 patients were observed prospectively for the development of postoperative infection [7]. Twenty-four patients were identified to have infection, as defined by criteria of the Center for Disease Control [8]. For the purpose of the present study, the records of these patients were reviewed for temperature pattern, date of onset of infection, and sites of infection. To obtain a comparative group, we reviewed the charts of 99 patients randomly selected from among those patients in whom infection did not develop. Since most uninfected patients were discharged by the tenth postoperative day, we recorded the daily maximum temperature from the day of operation through the ninth postoperative day. Most temperatures were measured orally; rectal temperatures were reduced by 0.5°C to conform to oral measurements [9]. Significant daily fever was defined as a maximal temperature \( \geq 38^\circ C \) (\( 100.4^\circ F \)) orally. The degree of statistical significance was tested by chi-square analysis.

Results
Of the 24 patients with infection, 5 were excluded because the infection developed after the ninth postoperative day. One was excluded because of inadequate clinical data. Among the remaining 18 patients, 7 had urinary tract infection, 8 had sternal wound infection, 2 had pneumonia, and 1 had an infection on the upper thigh where the saphenous vein was harvested. Three patients had bacteremia documented by positive blood cultures; it was associated with sternal wound infections in 2 and with pneumonia in 1.

Among the patients without infection, 44% (44 patients) had fever, as previously defined, on the day of cardiac operation, and two-thirds were febrile for two consecutive days thereafter. Fever rarely occurred after the fifth postoperative day (Fig 1). Only 1 patient had a temperature \( \geq 40^\circ C \). Analysis of the maximum temperature reading was not found useful in differentiating infected from uninfected patients.
Percentage of patients with fever

Patients with wound infections or pneumonia
Patients without infection

Fig 1. Fever in patients with nonurinary infections compared with noninfected patients. Numbers above bars indicate percentages.

Percentage of patients with fever

Patients with urinary tract infections
Patients without infection

Fig 2. Fever in patients with urinary infections compared with noninfected patients. Numbers above bars indicate percentages.

Comment
This study confirms previous reports on the high frequency of fever early after open-heart operation. Our number of infected patients was rather small. Nevertheless, we were able to demonstrate a statistically significant difference after the third postoperative day in the incidence of fever between uninfected patients and those with wound or pulmonary infections. As might be expected, patients with urinary infections, mainly secondary to Foley catheterization, did not have more frequent temperature elevations than the uninfected group.

Our findings differ from those of Bell and associates [1] from Massachusetts General Hospital, who found that the incidence of fever was not statistically different between patients with and those without infection after cardiac valve replacement. Their study population differed from ours, which was mainly male patients undergoing coronary artery bypass. The mean operation time in our study was only three hours, compared with five hours in their study. More importantly, the average length of hospitalization for our patients was 9 days compared with 26 days for their patients. Therefore, our review covered a shorter postoperative period. With reference to methodology, Bell and co-workers compared daily maximal and mean temperatures, while we studied percentages of patients with elevated temperature.

In agreement with the results of Bell and colleagues [1], we found no significant difference in the height of the maximal temperature. However, we did find that prolonged fever occurred frequently in patients with nonurinary infections.

It is interesting to compare the results of our study with two cardiac bypass studies performed around 15 years ago. Goodman and associates [5] found that postoperative fever and leukocytic response did not help to identify the presence of infection: for the first 6 days after operation, the temperatures of patients with and without infection were not statistically different. However, Fekety and co-workers [6] found that patients without infection had fever (rectal temperature $\geq 37.8^\circ C$) for an average of 3.9 days postoperatively and that only 2% of uninfected patients had fever that lasted more than 7 days.

One reason for the disparity in results may be the absence, in our series, of many patients with prolonged fever secondary to post-pericardiectomy syndrome. The incidence of this syndrome is variable [2]. Roses and colleagues [3] reported that 28% of their patients requiring cardiac operation had unexplained, self-limited temperature elevation $>1.6^\circ C$ after the first postoperative week. Livelli and co-workers [2] found that after cardiac operation, 54% of their patients had unexplained, self-limited fever (rectal temperature $\geq 37.8^\circ C$) beyond the sixth postoperative day. In contrast, less than 10% of our uninfected patients had fever after the fourth postoperative day, and on the ninth postoperative day only 4% of these patients had a temperature of 38°C or greater. Most of our
patients were discharged by the tenth postoperative day, which shortened the time of observation for postpericardiotomy syndrome.

In our population of patients undergoing cardiac operation, we found that elevated temperature after the third postoperative day was a significant indicator of serious, deep-seated infection. If we extrapolate the results of this study to our original group of 263 patients (239 uninfected patients) [7], then approximately 25% of all patients with fever on postoperative days 4 through 9 would have serious postoperative infections. Early diagnosis and treatment, especially in sternal infections, is vital to prevent mortality or prolonged morbidity. The temperature chart should be observed carefully after heart operations. Fever after the third day should not be dismissed as benign “pump fever” until serious infection has been diligently sought and excluded.

References