Fever of Nosocomial Origin: Etiology, Risk Factors, and Outcomes

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OBJECTIVES: To identify the etiologies and risk factors associated with fever of nosocomial origin and compare the outcomes of patients with and without nosocomial fever.

DESIGN: A prospective study with a case-control component.

SETTING: The three medical services of a university hospital.

PATIENTS AND METHODS: We evaluated 100 patients with fever of nosocomial origin. Etiologies were assigned by the consensus of three independent reviewers using Centers for Disease Control guidelines. Predictors of bacterial etiology were identified using logistic regression methods. Controls matched for age (± 5 years), sex, and comorbidity were identified for 65 of the nosocomial fever cases. Cases and controls were compared with conditional logistic regression to identify risk factors for fever of nosocomial origin. Cases and controls were followed at 1 month to compare length of stay, mortality, and hospital readmission rates.

MEASUREMENTS AND MAIN RESULTS: An etiology was assigned in 81 cases: 51 had bacterial infection, 5 had nonbacterial infection, and 25 had a noninfectious etiology. Multivariate predictors of bacterial infection were the presence of diabetes mellitus (odds ratio [OR] = 5.74; 95% confidence interval of the odds ratio [CI] = 1.61 to 20.40), length of stay to fever onset after admission greater than 10 days (OR = 3.98, CI = 1.04 to 15.22), maximum temperature greater than 38.7°C (OR = 3.37, CI = 1.28 to 8.88), and white blood cell count greater than 10 × 10^9/L (OR = 4.64, CI = 1.68 to 12.77). Comparison of cases and controls indicated that patients with nosocomial fever had more invasive procedures in the 72 hours preceding enrollment in the study than controls (OR = 1.46, CI = 1.03 to 2.08). Although cases were hospitalized almost twice as long as controls (21.5 versus 12.5 days; p <0.0001), neither 30-day mortality nor hospital readmission rates differed between cases and controls.

CONCLUSION: Nosocomial fever often does not represent nosocomial infection and may constitute a wide variety of other conditions. Since bacterial etiology of fever is a major concern, clinical and laboratory findings can be used to predict patients at high risk for an infectious process. A reduction in the number of invasive procedures may decrease the incidence of nosocomial fever. New-onset nosocomial fever leads to an increase in length of hospital stay but is not a significant predictor of mortality.

Fever is a common clinical finding in hospitalized patients and is a cardinal manifestation of nosocomial infection. Nosocomial fever occurs in 2% to 31% of medical inpatients, and in up to 74% the fevers are due to bacterial infections [1-3]. In the United States alone, it is estimated that over 2 million hospital-acquired infections occur annually at a cost that exceeds 4 billion dollars [4,5].

The vast majority of prior studies of fever in hospitalized patients focused exclusively on patients with infectious etiologies [6-15]. Prior studies evaluated predominantly surgical, pediatric, gynecologic, obstetric, or nursing home patients [16-20] rather than patients hospitalized on internal medicine services [1-3]. Retrospective studies that focused on medical inpatients may have inadvertently included cases of community-acquired fever [1,2] or may not have systematically collected data on control patients [1,2].

The objectives of this study were to evaluate the etiology, identify the risk factors, and assess the prognosis of nosocomial fever. In the evaluation of etiology, we specifically attempted to identify predictors of bacterial infection among patients with nosocomial fever.
PATIENTS AND METHODS

We performed a prospective study with a case-control component on the 3 general medical services of Presbyterian University Hospital, a 636-bed university teaching hospital of the University of Pittsburgh Medical Center.

Selection of Cases

Fever of nosocomial origin was defined as an oral temperature greater than 38.0°C that occurred at least 48 hours after admission, and that was recorded on at least two occasions during any continuous 48-hour period. Axillary and rectal temperatures were corrected to oral temperatures by addition or subtraction of 0.4°C, respectively [21]. All patients 18 years or older admitted to a study service between December 1989 and March 1991, who met this definition of fever of nosocomial origin, were eligible to enter the study. Patients were excluded if they had a history of fever during the 7 days preceding admission, or if they did not consent to participate.

Patients were identified by daily review of nursing temperature logs by one of the investigators (MJA). Oral temperature was routinely measured at least twice a day in all patients on all three medical services, and recorded in a log kept at each nursing station. Charts of all patients with a temperature greater than 38.0°C were screened, and eligible patients were asked to participate.

Selection of Controls

A control patient was sought for each study patient. Potential control patients were prospectively identified from a daily hospital census report, and were inpatients at the same time as the cases. Chart reviews of all potential control patients were performed, and the first control meeting the matching criteria for each case was asked to participate in the study. Controls were matched to cases with respect to age (± 5 years), sex, site of care (i.e., the specific medical ward of the treatment), and level of comorbidity. Comorbidity was measured with the Charlson Comorbidity Index [22] designed to take into account the number as well as the severity of comorbid diseases. Cases and controls were matched ± 2 points on this scale, which ranges from 0 to 28 points. Controls were selected from patients who had remained afebrile during their hospital stay and were hospitalized for at least as long as cases at the time of fever onset. If a subsequent fever developed in a patient identified as a control, another control was selected.

Patient Assessment

Demographic data, history and physical examination findings, laboratory results, and information about procedures were collected on both cases and controls. In cases only, information about potential etiology of the fever, symptoms, clinical and laboratory findings at fever onset, and amount and duration of temperature elevation was collected. Data were obtained by chart review and history and physical examination. Admission APACHE II [23] scores were calculated for cases and controls.

The duration of the febrile episode was defined as the total number of consecutive days with a temperature greater than 38.0°C. An episode was defined as resolved after 5 days of normal daily temperature. When cases had more than a single febrile episode during the period of hospitalization, only the first episode was evaluated. The time to onset for the fever was defined as the days of hospital stay until the onset of fever and was measured in days.

Etiology of Fever

The etiology of fever in cases was classified into four broad categories: bacterial infections, nonbacterial infections, noninfectious etiology, and unknown etiology. Within each etiologic category, all cases were classified according to a specific cause of fever. Bacterial infections were classified according to the source of the infection, and noninfectious cases were classified by organ system or pathophysiologic process considered to be the source of fever. The etiologic categories and definitions for the specific cause of fever were based on guidelines developed by literature review, and criteria established by the Centers for Disease Control (see Table I) [24]. Each case was independently reviewed by three investigators who assigned an etiologic category and specific cause of fever. The assigned etiologic category and cause of fever were based on the consensus opinion of the three reviewers.

Assessment of Outcomes

Cases and controls were followed throughout their hospital stay. Length of stay was evaluated in all patients. Thirty-day follow-up information on mortality and hospital readmission rates was obtained by telephone contact in patients discharged from the hospital, and by chart review in those who remained hospitalized over 1 month from the enrollment date.

Methods of Analysis

Febrile cases were categorized into bacterial and nonbacterial etiologies. The univariate correlates of bacterial etiology were analyzed by the χ² test for categorical variables and Student’s t-test for continuous variables. Variables with a p value less than
This table describes the criteria used to assign the etiology of nosocomial fever. It includes a description of the four broad etiologic categories of fever as well as the specific causes for each category.

**Bacterial infection:** Bacterial infection was diagnosed following modified criteria developed by the Hospital Infections Program, Centers for Disease Control. Criteria applicable to our study are as follows:

- **Bloodstream infection:** Pathogen isolated from blood culture.
- **Pneumonia:** New or progressive infiltrate, consolidation, cavitation, or pleural effusion and purulent sputum.
- **Urinary tract infection:** A urine culture of ≥100,000 colonies/mL with no more than two species of organisms.
- **Vascular infection:** Any of the following: organism isolated from culture of arteries or veins removed during surgery; evidence of infection at an involved vascular site during surgery or by histopathologic examination; more than 15 colonies cultured from catheter tip and no organism isolated from blood cultures. In the absence of these criteria, we used any evidence of an inflammatory process at an involved vascular site with negative blood cultures.
- **ENT infection:** Pathogen isolated from purulent exudate from conjunctiva or contiguous tissues including ear canal or ear structures during surgery or diagnostic procedures, or histopathologic evidence of infection on any of these organs. In the absence of these criteria, we used exudate from conjunctiva or contiguous tissues and pain or redness of the conjunctiva; pain, redness with exudate or drainage from the ear canal or middle ear; sinus pain with purulent exudate or radiographic evidence of sinusitis; or sore throat with pharyngeal exudate.
- **Gastrointestinal system infection:** Pathogen isolated from stool culture or rectal swab or from an intra-abdominal source. Evidence of intra-abdominal infection seen during surgery or by histopathologic examination or radiographic evidence of abdominal collection.
- **Bronchitis:** Organism isolated from culture obtained by deep tracheal aspirate or bronchoscopy and no evidence of pneumonia. In the absence of cultures, we used cough and sputum production and no pulmonary infiltrate.
- **Skin and soft tissue infection:** Organism isolated from culture of aspirate or drainage from affected site or evidence of infection seen during surgery or histopathologic examination. In the absence of cultures, we used localized inflammatory process with tenderness, swelling, heat with or without purulent discharge from pustules, vesicles, ulcers, or other lesions.

**Nonbacterial infection:** Was diagnosed on clinical grounds and/or additional microbiologic or laboratory information to exclude bacterial infection.

**Noninfectious etiology:** A diagnosis of exclusion made in the absence of the criteria delineated under "Bacterial infection" and "Nonbacterial infection" above. Clinical evidence of a noninfectious disease known to be associated with fever also had to be present. Diagnoses were classified according to the organ systems and/or disease process presumed to be the source of fever as follows:

- **Malignancy.**
- **Cardiovascular disorders.**
- **Respiratory system disorders.**
- **Gastrointestinal system disorders.**
- **Central nervous system disorders.**
- **Autoimmune diseases.**
- **Hematologic disorders.**
- **Drug fever:** Said to exist if the temperature elevation was temporally associated with administration of a sensitizing medication and if fever resolved within 72 hours of the discontinuation of the medication.
- **Procedure-related fever:** Said to exist if there was a transient temperature elevation in a period of up to 48 hours following an invasive diagnostic procedure or following transfusion of blood products and no evidence of infectious disease as defined above.
- **Miscellaneous:** All other known but unclassified causes.

**Unknown etiology:** All remaining patients without a definite diagnosis according to the above criteria.

*ENT = ears, nose, and throat.*

0.1 in the univariate analyses were entered into logistic regression models to determine the multivariate predictors of bacterial etiology. Comparison of laboratory values between admission and fever onset was performed with paired t-tests [25]. To assess the usefulness of the degree of initial temperature elevation in predicting bacterial infection, we used receiver operating characteristic (ROC) curve analyses [26].

Cases were compared with controls using McNemar's test for matched dichotomous variables [25], Wilcoxon matched-pairs signed-rank tests for polytomous variables [27], and paired t-tests for continuous variables [25]. In all univariate analyses, a two-tailed α of less than 0.05 was used as the significance level. All variables that differentiated cases from controls with p < 0.10 were included in multivariate conditional logistic regression analyses [28].

The survival experiences of cases and controls were compared with the log rank statistic with matching preserved through stratification [29]. Overall mortality and readmission were compared with McNemar's statistic. Length of stay was compared with the Wilcoxon matched-pairs signed-rank test [27].

**RESULTS**

From December 1989 to March 1991, 108 patients...
TABLE III

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Patients (n = 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial infection</td>
<td>51</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>18</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>12</td>
</tr>
<tr>
<td>Bloodstream infection</td>
<td>10</td>
</tr>
<tr>
<td>Vascular infection (thrombophlebitis)</td>
<td>4</td>
</tr>
<tr>
<td>Other*</td>
<td>7</td>
</tr>
<tr>
<td>Nonbacterial infections</td>
<td></td>
</tr>
<tr>
<td>Upper respiratory infection</td>
<td>5</td>
</tr>
<tr>
<td>Pneumocystis carinii pneumonia</td>
<td>2</td>
</tr>
<tr>
<td>AIDS</td>
<td>1</td>
</tr>
<tr>
<td>Aseptic meningitis</td>
<td>1</td>
</tr>
<tr>
<td>Noninfectious etiology</td>
<td>25</td>
</tr>
<tr>
<td>Procedure-related</td>
<td>5</td>
</tr>
<tr>
<td>Drug fever</td>
<td>5</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>3</td>
</tr>
<tr>
<td>Hematoma</td>
<td>2</td>
</tr>
<tr>
<td>Sickle cell crisis</td>
<td>2</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>2</td>
</tr>
<tr>
<td>Malignancy</td>
<td>2</td>
</tr>
<tr>
<td>Neurologic malignant syndrome</td>
<td>1</td>
</tr>
<tr>
<td>Subarachnoid hemorrhage</td>
<td>1</td>
</tr>
<tr>
<td>Connective tissue disease</td>
<td>1</td>
</tr>
<tr>
<td>Acute gouty arthritis</td>
<td>1</td>
</tr>
<tr>
<td>No apparent source</td>
<td>19</td>
</tr>
</tbody>
</table>

*The other causes include three intra-abdominal infections, two upper respiratory infections, one case of tracheobronchitis, and one soft tissue infection.

**These included three transfusions, one bronchoscopy, and one therapeutic arterial embolization.

met all study eligibility criteria for nosocomial fever. Eight patients declined to participate; the remaining 100 were enrolled in the study.

Characteristics of Patients With Nosocomial Fever

Table II describes the demographic and clinical characteristics of patients with nosocomial fever. Their mean age was 59.4 years with a range of 22 to 90 years. Sixty-five cases were admitted from an emergency room, 23 were admitted from outpatient clinics, and 12 were transferred from other hospital care facilities. The five most common comorbid illnesses were hypertension, diabetes mellitus, neoplastic disease, chronic renal failure, and congestive heart failure. The mean comorbidity index score was 3.6 with a range of 0 to 11. The mean APACHE II score was 9.9 with a range of 0 to 23.

Febrile Episode

The mean time from admission to the development of fever was 7.3 days with a range of 2 to 45 days. The mean duration of the febrile episode was 3.6 days with a range of 1 to 16 days. The mean temperature at the onset of fever was 38.4°C with a range of 38.1°C to 40.0°C. The mean maximum temperature (highest temperature recorded at any time during the febrile episode) was 38.8°C with a range of 38.1°C to 40.6°C.

Localizing symptoms or signs at the time of fever onset were present in 46 patients (e.g., new rales, respiratory rate greater than 24/min, and new productive cough, all suggestive of pneumonia). The remaining 54 patients had no apparent source of infection based on history or physical examination at the onset of the febrile illness. Of the 25 noninfectious cases, 5 were temporally closely related to specific procedures. Of the remaining 20 patients, 15 had signs and symptoms referable to these etiologies.

The mean white blood cell (WBC) count at the onset of fever was 9.6 X 10^9/L (with a range of 1.3 to 22.4 X 10^9/L). The WBC count at fever onset was significantly higher than the admission mean WBC count of 8.2 X 10^9/L (p < 0.0001). Four febrile patients had a WBC count lower than 3.5 X 10^9/L, none of whom had a history of malignancy or who had received immunosuppressive treatment prior to the episode.

Diagnostic Evaluation of the Febrile Episode

Blood cultures were obtained in 88 patients, urine cultures in 79 patients, and chest radiographs in 90 patients. Of these, blood cultures were positive in 10 (plus 2 were considered contaminants), urine cultures were positive in 27, and chest radiographs were reported as showing a new pulmonary infiltrate in 15 patients. Cultures other than blood and urine were obtained according to patients' clinical presentation. These additional positive culture results included 18 sputum cultures (7 of them in patients with a new pulmonary infiltrate on chest radiograph), 6 venous catheter-tip cultures (2 considered contaminants), 2 biliary tract cultures, 1 ascitic fluid culture, 1 wound culture, and 1 pharyngeal culture for β-hemolytic streptococci.
TABLE V
Multivariate Predictors of Bacterial Infection in Patients With Nosocomial Fever

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Odds Ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus</td>
<td>5.74</td>
<td>1.61-20.40</td>
</tr>
<tr>
<td>LOS to fever onset &gt; 10 days</td>
<td>3.98</td>
<td>1.04-15.22</td>
</tr>
<tr>
<td>T max &gt; 38.7°C</td>
<td>3.37</td>
<td>1.28-8.88</td>
</tr>
<tr>
<td>WBC &gt; 10 X 10⁹/L</td>
<td>4.64</td>
<td>1.68-12.77</td>
</tr>
</tbody>
</table>

LOS = length of hospital stay; T max = maximum temperature during the febrile episode; WBC = white blood cell count at onset of fever.

*95% CI = 95% confidence interval based on asymptotic calculations.

Etiology of Fever

Table III shows the etiologic categories and causes of fever. In 98 cases, 2 of 3 reviewers agreed on the specific etiology of the fever. In the remaining two cases, a specific cause was assigned after discussion among the three reviewers yielded a consensus opinion. Fifty-one patients had bacterial infection, 5 had nonbacterial infection, 25 had noninfectious etiologies, and 19 had no apparent source of fever. The most common bacterial infections were urinary tract infections, pneumonias, and bloodstream infections.

Of the 51 patients with bacterial infection, 34 patients (66.6%) received antibiotics at the onset of fever, and 17 patients after the results of cultures or other diagnostic tests were reported. Among the 49 patients without bacterial infection, antibiotics were given to 15 (31%) for a mean duration of 6.6 days.

Predictors of Bacterial Etiology

Table IV lists the significant univariate predictors of bacterial infection among patients with nosocomial fever. They include six clinical factors (age greater than 60 years, diabetes mellitus, hypertension, length of stay to fever onset greater than 10 days, presence of an indwelling bladder catheter, and maximum temperature greater than 38.7°C) and two laboratory factors (WBC count greater than 10 X 10⁹/L and greater than 75% neutrophils at the onset of the febrile episode).

Although the maximum temperature during the febrile episode was associated with a bacterial etiology, 34 of 51 patients (66.6%) with a bacterial etiology had a maximum temperature elevation less than or equal to 38.4°C. ROC curve analysis revealed that no initial temperature threshold was able to increase the likelihood of diagnosing a bacterial infection beyond that of chance alone. The presence of chills at the onset of fever, degree of initial temperature elevation, number of invasive procedures in the 72 hours preceding fever, level of comorbidity, APACHE II scores, and laboratory variables other than the WBC count did not differ between patients with and without bacterial etiologies.

Table V shows the multivariate predictors of bacterial infection among patients with nosocomial fever. A history of diabetes mellitus, length of stay to fever onset greater than 10 days, maximum temperature greater than 38.7°C, and a WBC count greater than 10 X 10⁹/L at fever onset were independent predictors of bacterial etiology. All patients with three or more of these predictors (n = 11) had bacterial infections.

Risk Factors for Nosocomial Fever: Case-Control Analyses

Appropriate controls were identified for 65 of the fever cases. Table VI compares the demographic and clinical characteristics of cases and controls. Race, emergency room admission rates, mean APACHE II scores, and type of insurance coverage were not significantly different among these groups. The frequency of the majority of individual comorbid conditions (hypertension, stroke, dementia, neoplastic disease, obstructive pulmonary dis-
This study identified four predictors of bacterial etiologies of fever that are easily obtained or measured. All patients with three or four of these predictors had bacterial infections.

Contrary to prior reports [2,3], this study did not find an increased mortality in patients with nosocomial fever. However, unlike the previous studies, the present study was designed to control for co-morbidity and age, two important predictors of mortality. As in a previous report, we did find a modest univariate relationship between DNR status and nosocomial fever [3]. On average, patients with nosocomial fever spent 9 days longer in the hospital than matched controls, indicating that the control of nosocomial fever has the potential for reducing use of hospital resources.

Etiology of Nosocomial Fever

The etiology of fever was established in 81% of cases. Only half of the febrile patients were found to have a bacterial infection. Factors independently correlated with bacterial infections included higher maximum temperature, diabetes mellitus, WBC counts more than 10 x 10^9/L, and length of stay to fever onset greater than 10 days. It is well recognized that patients with diabetes mellitus have increased susceptibility to infection. Furthermore, a correlation with maximum temperature and WBC counts is expected since these are the cardinal manifestations of bacterial infections. Additionally, the risk of nosocomial infection is higher with longer length of stay, most likely because of longer duration of exposure to pathogens and procedures in the hospital setting.

These correlates of bacterial infections can be used to select more appropriate initial use of antibiotics prior to the availability of culture results. All of the variables are available at the time of development of fever, with the possible exception of maximum temperature, which occasionally occurs later in the febrile episode. We found that 30% of patients in our study were treated with antibiotics without initial findings to support a bacterial infection. On the other hand, only 67% of patients with bacterial infections were initially administered antibiotics immediately after the onset of fever. While this difference indicates that physicians are making appropriate early judgments about etiologies, it also points out how much antibiotic use could be decreased for patients without bacterial infections.

### Table VII

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Odds Ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcoholism</td>
<td>4.00</td>
<td>1.50–∞</td>
</tr>
<tr>
<td>Angina</td>
<td>0.18</td>
<td>0.00–0.44</td>
</tr>
<tr>
<td>DNR status</td>
<td>4.50</td>
<td>1.75–∞</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>0.13</td>
<td>0.00–0.50</td>
</tr>
<tr>
<td>Number performed</td>
<td>1.46^f</td>
<td>1.03–2.08</td>
</tr>
<tr>
<td>Indwelling bladder catheter</td>
<td>2.50</td>
<td>1.48–∞</td>
</tr>
</tbody>
</table>

### Comments

This study is similar to prior reports showing that an etiology of nosocomial fever can be identified in 72% to 88% of patients [3]. However, identification of the etiology can be costly in terms of time and resource use, because only 46% of the cases had clinical signs or symptoms suggestive of the cause of fever. More complete diagnostic evaluations were necessary in most cases. This study identified four predictors of bacterial etiologies of fever that are easily obtained or measured. All patients with three or four of these predictors had bacterial infections.

The number of diagnostic or therapeutic procedures in 72 hours preceding the febrile episode or enrollment date. This value is missing for control subjects enrolled less than 72 hours after admission. There are only 51 valid pairs when this variable is considered. No difference of t2 procedures is 2.14, for a difference of -1 is 0.68 as derived from the conditional logistic regression model.
infections and how many patients with bacterial infections could benefit from earlier use of antibiotics. These data highlight the need for strategies for more judicious use of antibiotics in patients with nosocomial fever.

Clinicians often rely on the degree of initial temperature elevation as a threshold for obtaining cultures or starting antibiotic therapy in patients with nosocomial fever. Our data indicate that in hospitalized medical patients, the probability of bacterial infection is not higher when the initial temperature is greater than 38.5°C or between 38°C and 38.5°C. The majority of patients with bacterial infection (72%) had an initial temperature less than 38.5°C, a finding that is similar to the results in patients presenting to an emergency room with fever [30]. Our study indicates the traditional cutoff of 38.5°C is not justifiable in searching for a bacterial etiology in a patient with a low-grade fever. We postulated that the lack of high temperature in nosocomial infections may be because older patients cannot mount a febrile response. However, we found no differences in initial or maximal temperature between older versus younger patients (age less than 60 years).

Risk Factors of Nosocomial Fever

The current study attempted to match cases and controls with respect to comorbid illnesses, and thus no comment can be made about the effect of overall comorbidity on the development of nosocomial fever. However, our study does show that the number of invasive procedures is predictive of nosocomial fever. Invasive procedures might cause fever by leading to transient bacteremia, abscesses, sterile inflammatory reactions, allergic or immune reactions (e.g., blood product transfusions), and introduction of exogenous factors such as pyrogens in dialysate [31,32]. One or more mechanisms may have contributed to fever in our patients. This finding has been previously reported by Filice et al [3], in whose study intravenous and indwelling urinary catheters were utilized twice as often in cases as compared with controls.

Effect of Fever on Outcomes

Two prior studies [2,3] suggested that patients with febrile illness had an increased mortality. However, these studies did not adjust for differences in underlying comorbidity and severity of illness. Our results suggest that the previously reported differences in mortality between patients with fever and controls may be largely explained by associated comorbidity.

A striking difference in length of stay was observed between cases and controls, indicating a major effect on resource utilization due to nosocomial fever. This difference existed even when patients were matched for comorbidity level. The coexisting illnesses were not likely to have been a major contributor to the long length of stay. A longer length of stay was utilized for the management of the febrile illness.

The limitations of this study include the following: (1) Since this study was performed at a university hospital, the differences between our results and prior reports could be because of the study population or admission and care patterns, and (2) a comparison of outcomes on the whole cohort of febrile and nonfebrile patients could not be made. Larger studies of the outcomes would be needed to further clarify the role of comorbidity in mortality associated with nosocomial infections.

In conclusion, nosocomial fever often does not represent nosocomial infection and may constitute a wide variety of other conditions. Since bacterial etiology of fever is a major concern, clinical and laboratory findings can be used to predict patients at high risk for an infectious process. We recommend that the degree of initial oral temperature should not be used as a sole guide for initiating a search for a bacterial infection. A reduction in the number of invasive procedures, which partly depends on physicians’ practice patterns, may decrease the incidence of nosocomial fever. Finally, new-onset nosocomial fever leads to an increase in length of hospital stay but is not a significant predictor of mortality.

REFERENCES

21. Cranston WI, Gerbrandy J, Snell ES. Oral, rectal and esophageal tempera-