Nosocomial Febrile Illness in the Elderly

Frequency, Causes, and Risk Factors

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Background: Although nosocomial febrile illness (NFI) is common in hospitalized patients, it has been less extensively studied in the elderly.

Objective: To determine the frequency, causes, and risk factors of NFI in elderly inpatients.

Methods: This prospective study involved 608 patients (≥65 years of age) admitted in an acute geriatric unit. Investigators followed this cohort until 1 of the following events occurred: development of NFI, discharge from the geriatric unit, or death. The cause of NFI was classified into 3 groups: infectious, noninfectious, and no apparent diagnosis. We systematically studied 17 comorbid conditions, 6 drugs, and 7 invasive procedures. For comparison, the patients were stratified into 2 groups: patients with NFI and patients without NFI.

Results: Sixty-six patients (10.9%) with NFI were identified. They were compared with the remaining 542 patients without NFI. In 49 patients (74%) with NFI, the cause was infectious; in 9 (13.5%), it was noninfectious; and in 8 (12.5%), there was no apparent cause. After multivariate analysis, only fecal incontinence (odds ratio [OR], 5.54; 95% confidence interval [CI], 2.13-14.5), congestive heart failure (OR, 2.97; 95% CI, 1.53-5.76), and pressure ulcers (OR, 2.93; 95% CI, 1.19-7.17) were independent risk factors for NFI. The number of invasive procedures preceding the febrile episode was a significant predictor of infection (OR, 3.68; 95% CI, 1.14-9.21).

Conclusions: Nosocomial febrile illness is a common event in elderly hospitalized patients. In 74% of the patients with NFI, an infection is found. Measures to decrease infectious NFI in the elderly require a reduction in the number of invasive procedures.

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NOSOCOMIAL febrile illness (NFI) is defined as a fever occurring at least 48 hours after hospital admission.[1] The prevalence of NFI has been estimated at 2% to 31% for medical inpatients.[1-4] This wide range in prevalence rates is the result of differences in the definition of fever, methods of temperature measurement, age of patients, and type of medical unit. Although nearly two thirds of NFIs are secondary to infection, this illness may be associated with a wide variety of other conditions, such as tissue injury, immunologic reaction, or inflammatory processes.[1-4] Thus, NFI represents a frequent nonspecific clinical problem with potential consequences for morbidity and mortality.[1-4]

Previous reports in the elderly focused on fever in nursing home patients,[5-9] fever of unknown origin,[9-11] or nosocomial infections.[12-16] These studies showed that aging is associated with an increased risk of nosocomial acquired infection.[12,16]

Previous studies on NFI evaluated patients hospitalized in internal medicine units.[1,4] These studies, which included elderly and younger patients in the same group, failed to demonstrate potential risk factors for NFI (eg, dementia or protein-caloric malnutrition) specific to elderly patients.

The aims of this prospective cohort study were (1) to determine the frequency of NFI in hospitalized patients 65 years of age or older, (2) to identify the causes of NFI, and (3) to identify the risk factors for NFI, especially infectious NFI.

RESULTS

Sixty-six patients (10.9%) with NFI were identified during the study. The remaining 542 patients without NFI were the comparison group for the study. The mean ± SD age (85.2 ± 5.2 years for patients with NFI vs 84.2 ± 6.3 years for patients without NFI) and the sex ratio (male-female, 0.32 vs 0.47) were not significantly different between the 2 groups ($P>.05$). The main reasons for pa-

PATIENTS AND METHODS

PATIENT POPULATION

The University Hospital of Rouen in Rouen, France, is a 2362-bed tertiary-care hospital with a 45-bed geriatric medicine unit. More than 85% of the elderly patients admitted to this geriatric department are admitted directly from the emergency unit of the hospital. The mean length of stay in the geriatric unit is 10 days.

A total of 608 of the 880 patients who were 65 years of age or older and who were admitted to the geriatric unit between January 1995 and January 1996 were included in the study. Patients who (1) stayed for less than 48 hours in the unit (n = 80); (2) had a history of fever or antibiotic treatment during the 8 days before hospitalization or during the first 2 days of hospitalization (n = 50); (3) had been institutionalized (in nursing homes as well as in other long-term care facilities) or hospitalized during the 15 days preceding hospitalization (n = 122); or (4) did not consent to participate (n = 20) were excluded. Two investigators prospectively evaluated this cohort until 1 of the following events occured: development of NFI, discharge from the geriatric unit, or death.

DATA COLLECTION

During the first 24 hours of hospitalization, all patients underwent a detailed medical history taking and a physical examination performed by study investigators. Known and potential risk factors for NFI were identified from a systematic review of the medical literature.[1-8,12-15] Seventeen comorbid conditions were systematically investigated by review of medical records and patient interviews: (1) dementia (according to the *Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition*[17]); (2) congestive heart failure (New York Heart Association classes III and IV); (3) urinary incontinence (ie, at least 1 accident per day); (4) prostate disease (eg, benign prostate hyperplasia); (5) chronic renal failure (ie, creatinine clearance, <0.83 mL/s [<50 mL/min]); (6) fecal incontinence (defined as deficient control of stools with normal consistency); (7) bedridden (a Karnofsky score of 10 to 30); (8) pressure ulcers (stages 2, 3, and 4 of the National Pressure Ulcer Advisory Panel); (9) neoplastic disease; (10) malnourishment (as manifested by poor dietary intake or inability to feed oneself and confirmed by a body mass index of <20 kg/m^2); (11) stroke; (12) difficulty with oropharyngeal secretions (eg, swallowing difficulties in patients with stroke or Parkinson disease); (13) chronic obstructive pulmonary disease; (14) diabetes mellitus; (15) recent surgery; (16) alcoholism (up to 75 g of alcohol per day); and (17) cirrhosis. Seven invasive procedures were also investigated: intravenous catheter, indwelling urinary catheter, intermittent urinary catheter, gastroscopy, nasogastric tube, colonoscopy, and bronchoscopy.

Ward nurses routinely recorded all rectal temperature measurements twice a day. The criterion for fever in the elderly varies among clinicians and investigators. In this study, NFI was defined as a rectal temperature above 37.8°C occurring at least 48 hours after admission. This temperature threshold was chosen because elderly patients with serious bacterial infections may present with only minor temperature elevations.[18,19] The duration of the febrile episode was defined as the number of consecutive days with a body temperature higher than 37.8°C. The duration of hospitalization before and after the onset of fever was noted for each case. During hospitalization, all invasive procedures were recorded for each patient until the development of fever or discharge from the unit.

An x-ray film of the chest, a white blood cell count, 3 blood cultures (Aero-anaerobies Biomerieux Laboratories), and a urinary sample for culture were obtained in all febrile patients. Other laboratory tests were performed according

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tients' admission were falls (20%), altered general state (18%), congestive heart failure (16%), dementia (15%), depression (9%), and miscellaneous (22%). There was no difference between the 2 groups.

FEBRILE EPISODE

The mean ± SD time from admission to the onset of fever was 8.2 ± 7.7 days (range, 3-36 days; median, 4 days). The mean ± SD duration of the febrile episode was 4.1 ± 2.9 days (range, 2-16 days). The mean ± SD temperature at the onset of fever was 38.1°C ± 0.3°C (range, 37.9°C-40°C). None of the patients had initial hypothermia (rectal temperature <35.5°C), but 2 patients with secondary blood infections had hypothermia after 48 hours of fever.

CAUSES OF FEVER

Table 1 lists the causes of NFIs. In 60 cases, all 3 reviewers agreed on the specific cause of the NFI. In 3 cases (1 vascular infection, 1 skin infection, and 1 hematoma), 2 of the 3 reviewers agreed. In the remaining 3 cases (1 bronchitis, 1 drug fever, and 1 no apparent diagnosis), a specific cause was assigned after consensus. In 49 cases (74%), the cause was infectious; in 9 cases (13.5%), it was noninfectious; and in 8 cases (12.5%), there was no apparent diagnosis.

A white blood cell count, blood and urine cultures, and chest x-ray films were obtained for all 66 patients. The blood cultures were positive for organisms in 5 patients (7.6%); the urine cultures were positive for organisms in 26 patients (39.4%); and the chest x-ray films revealed abnormalities in 13 patients (19.6%).

The most common infectious site was the urinary tract (n = 26); 16 (61.5%) of the urinary tract infections were in catheterized patients. Seventeen patients had respiratory tract infections, and 6 had miscellaneous sites of infection (vascular infection, skin and soft tissue infection, peritonitis, and diverticulitis). There were no primary blood infections during the study, but 5 patients (7.6%) had secondary blood infections.

Most pathogens were identified by urine culture: *Escherichia coli* (n = 13), *Proteus mirabilis* (n = 4), *Pseudomonas aeruginosa* (n = 3), *Enterococcus* species (n = 2), *Staphylococcus aureus* (n = 2), and *Klebsiella* species (n = 1). The urinary tract was the most frequent source of bacteremia (3 *E coli* and 1 *S aureus*), and 1 patient had pneumococcal bacteremia. Two additional positive cultures

to each patient's clinical presentation. Serologic tests (for influenza and *Mycoplasma*, *Legionella*, and *Chlamydia* organisms) were not required to determine the cause of the NFI. The first organism isolated after the diagnosis of fever was considered the causal organism.

CAUSES OF FEVER

The cause of NFI was independently determined for each case at the time of discharge by 3 investigators and classified into 3 groups: (1) infectious, (2) noninfectious, and (3) no apparent diagnosis. If the 3 reviewers were unable to find 1 clear diagnosis, they attempted to reach consensus. Unclear diagnoses were noted as "no apparent diagnosis."

Definitions of the infectious causes of fever were based on previous studies,[1-9] on criteria established by the Centers for Disease Control,[20] and on the definitions of infection for surveillance in long-term care facilities that are more adapted for elderly patients.[21] The diagnosis of pneumonia was based on the presence of a new or progressive infiltrate, consolidation, cavitation, or pleural effusion on the chest x-ray film with clinical signs, such as cough and/or purulent sputum, with or without isolated organisms. Bronchitis was defined as cough and sputum without pulmonary infiltrate. The diagnosis of urinary tract infection was based on clinical signs associated with the presence of pyuria (≥10 white blood cells per cubic millimeter) on urinalysis and bacteriuria (≥100 000 colonies per milliliter) with no more than 2 species of organisms and the absence of any other source of infection. Primary blood infection was defined as a pathogen isolated in the blood sample, without an accompanying infectious site (as opposed to secondary blood infection). The diagnosis of vascular infection was based on evidence of infection at the intravenous catheter site, with or without isolated organisms. Skin and soft tissue infections were defined as a localized inflammation with tenderness, swelling, and heat, with or without an organism isolated from pustules, vesicles, ulcers, or other lesions. Peritonitis was defined by clinical signs, with a pathogen isolated in the ascitic fluid. Diverticulitis was diagnosed from clinical signs, with or without pathogens isolated from stool culture, and confirmed by colonoscopy. Noninfectious causes of fever included myocardial infarction, stroke, thrombosis, malignancy, drug reaction, and procedure-related and other possible causes as described in the literature.[1-4] Drug-reaction fever was said to exist if the temperature elevation was temporally associated with the administration of a sensitizing medication and if the fever resolved within 72 hours of the discontinuation of the medication. Procedure-related fever was said to exist if there was a transient elevation in temperature 48 hours or less after an invasive procedure (eg, colonoscopy, gastroscopy, or transfusion of blood products) and no evidence of infectious disease as defined above.[1]

STATISTICAL ANALYSIS

At the end of follow-up, patients were divided into 2 groups: patients with NFI based on previous criteria and patients without NFI. Categorical data were analyzed using the χ^2 or Fisher exact test when samples were not large enough. Continuous variables were expressed as mean ± SD and were compared between the 2 groups using the Student *t* test or the Mann-Whitney test for nonparametric parameters. In the initial analysis, 24 categorical and 4 continuous variables were evaluated. Univariate correlates of NFI ($P<.10$) were then entered into a stepwise logistic regression analysis that identified the independent risk factors for NFI. Infectious NFI cases were also compared with noninfectious NFI cases, using the same strategy, to determine the multivariate predictors of infectious cause. Data were analyzed with a statistical software package (BMDP, University of California, Los Angeles) on a digital computer (Microvax II).

were an ascitic fluid culture (*Enterococcus faecalis*) and a wound culture (*S aureus*). Serum samples were obtained for serologic diagnosis in 10 patients (15.2%), and the results were negative.

The most frequent noninfectious causes of NFI were stroke and myocardial infarction. All 8 undiagnosed episodes resolved promptly, often lasting less than 72 hours.

The mean temperature at the onset of fever was not statistically different between patients with infectious disease and patients with other diagnoses ($P>.05$). Only 4 patients (8%) with infectious NFI had a temperature above 38.5°C at the onset of fever. For the white blood cell count at the onset of fever, the mean ± SD number of leukocytes was significantly higher in patients with infectious NFI ($10.1 \pm 4.8 \times 10^9$/L) than in patients with noninfectious NFI ($7.3 \pm 2.6 \times 10^9$/L; $P<.01$).

COMORBID CONDITIONS

Table 2 shows the comparison of comorbid conditions on admission between patients with and without NFI. Dementia (53% vs 36.2%), congestive heart failure (48.5% vs 31%), urinary incontinence (45.5% vs 22.3%), pressure ulcers (22.8% vs 8.3%), and fecal incontinence (19.7% vs 6.5%) were significantly more frequent in patients with NFI than in patients without NFI. Patients with NFI had a significantly greater average number of comorbid conditions (2.9 ± 1.8) than patients without NFI (2.0 ± 1.8, $P<.001$).

INVASIVE PROCEDURES

The invasive procedures that the patients with and without NFI underwent are listed in **Table 3**. The mean ± SD number of invasive procedures in patients with NFI (1.7 ± 1.3) was significantly higher than in patients without NFI (1.0 ± 1.1, $P<.001$). Four of the 7 invasive procedures listed were significantly more frequent in patients with NFI than in controls: intermittent placement of urinary catheters and placement of indwelling urinary catheters, nasogastric tubes, and intravenous catheters. None of the patients had suprapubic urinary catheters or central venous catheters. The percentages of patients with intermittent (17% vs 10.6%, $P=.05$) and indwelling (27.3% vs 12.4%, $P<.001$) urinary catheters were greater in the NFI group than in the non-NFI group. Among the patients who had indwelling urinary catheters, the mean ± SD duration of catheterization before fever was 6.5 ± 8.7 days (range, 2-25 days).

Table 1. Causes of Nosocomial Febrile Illness in 66 Patients

Cause	Patients, No. (%)
Infectious	
Urinary tract infection	26* (39.4)
Pneumonia	13† (19.6)
Bronchitis	4 (6)
Vascular infection	2 (3)
Skin and soft tissue infection	2 (3)
Peritonitis	1 (1.5)
Diverticulitis	1 (1.5)
Total	**49** (74)
Noninfectious	
Stroke	2 (3)
Myocardial infarction	2 (3)
Thrombosis	1 (1.5)
Hematoma	1 (1.5)
Malignancy	1 (1.5)
Drug-related fever‡	1 (1.5)
Procedure related§	1 (1.5)
Total	**9** (13.5)
No apparent diagnosis	**8** (12.5)

**Four patients had secondary bloodstream infection and 1 patient had prostatitis.*
†One patient had secondary bloodstream infection.
‡Cimetidine.
§Gastroscopy.

Table 2. Comorbid Conditions on Admission in Patients With and Without Nosocomial Febrile Illness (NFI)

Characteristic	No. (%) Patients With NFI (n = 66)	No. (%) Patients Without NFI (n = 542)	*P*
Dementia	35 (53)	196 (36.2)	.01
Congestive heart failure	32 (48.5)	168 (31)	.01
Urinary incontinence	30 (45.5)	121 (22.3)	<.001
Pressure ulcers	17 (22.8)	45 (8.3)	.001
Chronic renal failure	14 (21.2)	144 (26.6)	.43
Fecal incontinence	13 (19.7)	35 (6.5)	.001
Bedridden	11 (16.6)	61 (11.2)	.28
Neoplastic disease	10 (15)	90 (16.6)	.90
Malnourished	9 (13.6)	45 (8.3)	.23
Stroke	9 (13.6)	44 (8)	.20
Difficulty with oropharyngeal secretions	8 (12)	30 (5.5)	.07
Chronic obstructive pulmonary disease	5 (7.5)	40 (7.4)	.85
Diabetes mellitus	5 (7.5)	42 (7.7)	.85
Alcoholism	2 (3)	19 (3.5)	.87
Parkinson disease	1 (1.5)	15 (2.8)	.85
Surgery <30 days	1 (1.5)	7 (1.3)	.67
Cirrhosis	0 (0)	9 (1.6)	.61

RISK FACTORS FOR NFI

Table 4 shows the multivariate risk factors for NFI in elderly hospitalized patients. Congestive heart failure, fecal incontinence, and pressure ulcers were independent risk factors for NFI. We also compared infectious (n = 49) with noninfectious (n = 17) cases of NFI. The multivariate conditional logistic regression analysis indicated that the number of invasive procedures preceding the febrile episode was the only significant predictor of an infectious origin (odds ratio, 3.68; 95% confidence interval, 1.47-9.21; *P* = .01). However, the number of cases was too small to systematically confirm this association, and other predictors are also probably important.

Table 3. Number of Invasive Procedures in Patients With and Without Nosocomial Febrile Illness (NFI)

Invasive Procedure	No. (%) Patients With NFI (n = 66)	No. (%) Patients Without NFI (n = 542)	*P*
Intravenous catheterization	38 (57.6)	241 (44.5)	.05
Indwelling urinary catheterization	18 (27.3)	67 (12.4)	.001
Intermittent urinary catheterization	11 (17)	48 (10.6)	.05
Gastroscopy	6 (9)	59 (11)	.81
Nasogastric tube placement	5 (7.5)	12 (2.2)	.05
Colonoscopy	4 (6)	15 (3)	.28
Bronchoscopy	0 (0)	3 (0.5)	.75

Table 4. Multivariate Risk Factors for Nosocomial Febrile Illness in Elderly Hospitalized Patients*

Predictor	OR	95% CI	*P*
Fecal incontinence	5.54	2.13-14.5	<.001
Congestive heart failure	2.97	1.53-5.76	.001
Pressure ulcers	2.93	1.19-7.17	.02

**OR indicates odds ratio; CI, confidence interval.*

EVOLUTION AND PROGNOSIS

The mean ± SD length of stay was significantly different in the NFI group (20.9 ± 13.4 days; range, 3-55 days) compared with the non-NFI group (12.1 ± 8.5 days; range, 3-70 days; *P*<.001). Nine patients (13.6%) with NFI and 57 patients (10.5%, *P* = .02) without NFI died during hospitalization.

Of the 66 patients with fever, 50 (76%) received antibiotics at the onset of fever. Antibiotics were prescribed for 45 (92%) of the 49 patients with infectious NFI and 5 (29%) of the 17 patients with noninfectious NFI. The mean ± SD duration of antibiotic treatment was 9.6 ± 5.6 days.

COMMENT

Although NFI is common in hospitalized patients,[1-4] data about the characteristics of elderly patients with this condition are rare. Prior studies have evaluated the frequency of fever in the institutionalized elderly.[5-8]

In our study, NFI developed in 10.9% of elderly hospitalized patients. In previous studies of medical services, the frequency of NFIs has been estimated at 2% to 31%.[1-4] The mean time from admission to the onset of fever was 8 days in our study. This value falls between the 7 days reported by Arbo et al[1] and the 13 days reported by Filice et al.[4]

The cause of NFI was established in 88% of our cases. These results are comparable to those of prior reports

showing that the cause of NFI could be identified in 72% to 88% of patients.[1-4]

In the present study, infections were the most frequent cause of NFI, occurring in 49 (74%) of the 66 patients with NFI. Also, the frequency of nosocomial infection was 8.8% in our population. The most frequent infectious sites were the urinary and respiratory tracts (18 [39%] and 9 [20%], respectively). In previous studies, the frequency of infectious NFIs was 56% in the study by Arbo et al[1] (mean patient age, 59 years), with 18% urinary tract infections and 14% respiratory tract infections, and 67% in the study by Filice et al[4] (mean patient age, 66 years). The difference in these results seems to indicate that the frequency of infectious NFI increases with age. This finding supports those of previous studies that have shown that elderly patients are at a particularly high risk of developing nosocomial infection.[12,16] A US study showed that among hospitalized patients aged 70 to 90 years, the frequency of nosocomial urinary tract infections, pneumonia, and wound infections increases 2- to 5-fold compared with younger patients.[16] Nevertheless, the frequency of infectious NFI is probably underestimated in the elderly because some cases may reflect "community-acquired" infections, especially because a febrile response in older patients can be delayed.[18] On the other hand, despite the common finding of fever in association with infection, a substantial proportion of older patients (25%) do not exhibit febrile responses in the presence of serious infectious diseases.[2,22] In our study, 92% of elderly infected patients had an initial temperature below 38.5°C, a higher percentage than the 72% in the study by Arbo et al.[1] In the study by Wasserman et al[23] on the predictive value of fever for bacterial infections in the elderly (mean patient age, 82 years), 48% of infected elderly patients were afebrile.

The upper limit of normal for temperature and the definition of fever (37.5°C-38.5°C) in the elderly are controversial,[18,19,22,23] but rectal temperature seems to be the temperature measurement that is clinically most useful in elderly patients.[19] In our study, elderly patients were considered pyrexial if their rectal temperature rose above 37.8°C on at least 2 occasions, because that is the usual practice in our unit and because this threshold has been used in previous studies in the elderly.[8,14] In the study by Wasserman et al[23] on the usefulness of fever in predicting bacterial infection in the elderly, the sensitivity for oral temperature (≥37.5°C; rectal temperature, ≥37.8°C or 37.9°C) was 50% and the specificity was 86%. In previous studies on NFI in internal medicine units,[1,4] the temperature cutoff was 38.4°C. However, our results in the elderly are very similar to those of the previous studies, which indicates that significant febrile illness may occur in elderly patients at much lower temperatures than in younger patients.

According to our classification, the frequency of noninfectious NFI was 13.5%. Acute ischemia (stroke or myocardial infarction) was the most frequent cause confirmed in our study and described in the literature.[1,4] One of our patients with myocardial infarction had Dressler syndrome. For the 2 patients in our study with stroke, we could not exclude the development of mild aspiration pneumonia by normal findings on the chest x-ray films. Moreover, these patients were treated with antibiotics. However, in the study by Filice et al,[4] 3 patients with NFI had strokes (2.4%) and 2 patients had myocardial infarction (1.6%).

In our study, the cause of 12.5% of the NFIs remain unexplained. Previous studies have reported a frequency of unexplained NFIs from 2.4% to 19%.[1,4] In the elderly, this uncertainty is partly attributable to multiple underlying illnesses. On the other hand, our investigations are not complete because in our unit, certain procedures, such as sputum culture or deep tracheal aspiration, were not performed, and serologic tests were not systematic. Also, viral infections, which were not investigated in our study, may be the cause of some of our unexplained NFIs.

The mean number of comorbid conditions was significantly higher in patients with NFI than in patients without NFI (2.9 vs 2.0). In the present study, multivariate analysis showed 3 independent predictors of NFI on admission in the elderly: a history of fecal incontinence, congestive heart failure, or pressure ulcers. These comorbid conditions, which are often associated with poor mobility and often require urinary catheters (for monitoring urinary output or for treating patients with sacral pressure ulcers), are frequent in the elderly, especially those in institutions.[24,25] If a history of congestive heart failure or pressure ulcers has been previously reported as a risk factor for NFI,[1,4] fecal incontinence is less commonly reported. The prevalence of fecal incontinence in hospitalized or institutionalized elderly patients ranges from 17% to 66%.[26] Fecal incontinence is frequently associated with cognitive impairment, poor mobility, and urinary incontinence.[26,27] This nonspecific digestive symptom is probably a marker of poor physical health rather than a risk factor of NFI per se.

Important risk factors for NFI (eg, diabetes mellitus or malignancy)[1,4] found in previous studies were not confirmed in our series. In the study by Filice et al,[4] the mean number of comorbid conditions for patients with NFI was 3.5, most frequently maligancy, foot ulcers, and cerebrovascular disease. In the study by Arbo et al,[1] the most common comorbid conditions shown to be risk factors for NFI were diabetes mellitus, malignancy, congestive heart failure, and chronic renal failure.

The number of invasive procedures before the onset of fever was the only clinical indicator of infectious NFI, independent of the procedure used. Also, when an elderly hospitalized patient presented with an NFI episode, the probability of an infection was increased 3.7-fold for each invasive procedure preceding the onset of fever. Other predictors of infectious NFI are probably important (particularly the white blood cell count), but the number of cases in our study was probably too small to identify these predictors. It is well recognized that the risk of nosocomial infection is highly correlated with the number of procedures performed in the hospital setting.[1,4] In our study, indwelling urinary catheters were used twice as often in patients with NFI than in controls. A urinary tract infection was diagnosed in 55% of all patients with NFI with indwelling or intermittent urinary catheters. However, although urinary catheters were more frequently used in patients with NFI, they were not associated with the risk of NFI in multivariate analysis. In most patients in the present study, the use of urinary catheter (indicated for urinary incontinence) may

probably be considered unjustified according to the guidelines proposed by Jain et al.[28] According to these authors, urinary catheters are indicated for managing urinary retention, monitoring urinary output in critically ill patients, and managing urinary incontinence when patients have sacral or perineal pressure ulcers, when the catheter is placed at the patient's request, and in terminally ill patients. In other situations, placement of urinary catheters for managing urinary incontinence is considered unjustified. Also, nursing staff convenience, a common observation in our study and in the study by Jain et al,[28] is not an acceptable indication. Placing a urinary catheter is clearly a medical prescription that requires a careful evaluation.

Older patients have been shown to have longer hospital stays owing to the severity and multiplicity of underlying conditions, prolonged recovery, and difficulties in postdischarge placement. Extended periods of stay contribute to increased exposure to invasive procedures and microbial pathogens, thus posing an important economic problem. We found that the mean length of stay was significantly increased in the patients with NFI. This may in part be a result of the number of comorbid conditions in this group or, more probably, of the management of the NFI.

As previously described in adults, this study showed an increased mortality in patients with NFI.[2,4] In the literature, the mortality rate has been estimated at 10.8% to 27.6% for patients with NFI.[1,2] However, it is difficult to dissociate the age-related mortality owing to the NFI from the confounding effect of underlying diseases.

Ninety-two percent of patients with infectious NFI and 29% of patients with noninfectious NFI were initially treated with antibiotics immediately after the onset of fever. Thus, an infectious cause was considered unlikely in at least 8% of the febrile episodes. However, none of the patients with infectious NFI who were not initially treated with antibiotics died. Thus, fever in elderly hospitalized patients without clear clinical or laboratory signs of an infectious origin does not justify prescribing a course of antibiotics.

In conclusion, NFI is a common clinical event in elderly hospitalized patients. Infection was found in 74% of the patients with NFI. A better understanding of the predisposing factors for NFI and infection in elderly hospitalized patients suggests some strategies that might be helpful in reducing the risk of NFI. For instance, reducing the number of invasive procedures may decrease the incidence of infectious NFI in elderly inpatients, particularly those with fecal incontinence, congestive heart failure, or pressure ulcers. In our study, the most frequent invasive procedures were intravenous catheterization and urinary catheterization. Also, it seems to be important for elderly patients who are at risk of infectious NFI to encourage a careful evaluation of the initial indication of urinary catheters and a greater use of alternatives such as patient training, biofeedback, medication, surgery, bedclothes, and condom catheters for men. Furthermore, the purpose of ongoing catheterization should be reviewed and documented daily. Using a predetermined list of durations appropriate for each indication for urinary or intravenous catheterization would also be helpful. To evaluate the impact of this strategy, more prospective studies including more acute care geriatric units are needed.

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