# Mupirocin Prophylaxis against Nosocomial *Staphylococcus aureus* Infections in Nonsurgical Patients

## A Randomized Study

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Background: ***Staphylococcus aureus*** **nasal carriage is a major risk factor for nosocomial *S. aureus* infection. Studies show that intranasal mupirocin can prevent nosocomial surgical site infections. No data are available on the efficacy of mupirocin in nonsurgical patients.**

Objective: **To assess the efficacy of mupirocin prophylaxis in preventing nosocomial *S. aureus* infections in nonsurgical patients.**

Design: **Randomized, double-blind, placebo-controlled trial.**

Setting: **3 tertiary care academic hospitals and 1 nonacademic hospital.**

Patients: **1602 culture-proven *S. aureus* carriers hospitalized in nonsurgical departments.**

Intervention: **Therapy with mupirocin 2% nasal ointment ($n$ = 793) or placebo ointment ($n$ = 809), twice daily for 5 days, started 1 to 3 days after admission.**

Measurements: **Nosocomial *S. aureus* infections according to defined criteria, in-hospital mortality, duration of hospitalization, and time to nosocomial *S. aureus* infection. *Staphylococcus aureus* isolates were genotyped to assess whether infection was caused by endogenous strains.**

Results: **The mupirocin and placebo groups did not statistically differ in the rates of nosocomial *S. aureus* infections (mupirocin, 2.6%; placebo, 2.8%; risk difference, 0.2 percentage point [95% CI, −1.5 to 1.9 percentage points]), mortality (mupirocin, 3.0%; placebo, 2.8%; risk difference, −0.2 percentage point [CI, −1.9 to 1.5 percentage points]), or duration of hospitalization (median for both, 8 days). However, time to nosocomial *S. aureus* infection was decreased in the mupirocin group from 12 to 25 days ($P$ > 0.2). A total of 77% of *S. aureus* nosocomial infections were endogenous.**

Limitations: **A few infections in both groups may have been missed because investigators assessed a patient for infection only if microbiology culture results were positive for *S. aureus*.**

Conclusion: **Routine culture for *S. aureus* nasal carriage at admission and subsequent mupirocin application does not provide effective prophylaxis against nosocomial *S. aureus* infections in nonsurgical patients.**

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*Staphylococcus aureus* is a frequent cause of nosocomial infections, including bacteremia and wound infections (1, 2). Approximately 25% of all nosocomial infections are caused by *S. aureus*, affecting both surgical and nonsurgical patients and leading to increased hospital stay, antibiotic use, costs, and mortality (3–5). Nasal carriers of *S. aureus* have an increased risk for these infections (6–9). Recent data show that 80% of nosocomial bacteremic *S. aureus* strains are endogenous and originate from the nose of *S. aureus* carriers (7). Since 20% of the population carries this pathogen persistently and 60% carries it intermittently, a substantial number of these nosocomial infections may be prevented by eliminating *S. aureus* from the nose (10).

Intranasal application of mupirocin twice daily for 5 days successfully eradicates *S. aureus* in 83% to 88% of carriers and reduces *S. aureus* hand carriage (8, 11–13). Several studies have shown that patients undergoing surgery or dialysis (peritoneal and hemodialysis) benefit from *S. aureus* eradication from the nose because of the reduction in nosocomial *S. aureus* infections (10). Mupirocin prophylaxis has been proven to be effective in preventing nosocomial *S. aureus* infections in randomized, placebo-controlled trials among dialysis and surgical patients and patients with recurrent skin infections (8, 14–17). Although the efficacy of mupirocin prophylaxis use has been confirmed only in these patients, mupirocin has many extralabel indications. The resulting widespread use has lead to mupirocin resistance (18). Since mupirocin is a major weapon to control methicillin-resistant *S. aureus* outbreaks, it should be used in a prudent and restrictive manner. Prudent use implies that it be used only for patients in whom it has proven efficacy.

The efficacy of mupirocin prophylaxis in a general nonsurgical patient population is not yet known. Therefore, we decided to study whether mupirocin prophylaxis in nasal *S. aureus* carriers hospitalized in nonsurgical wards decreases the incidence of nosocomial *S. aureus* infections. We assessed whether these nosocomial *S. aureus* infections were caused by endogenous strains, and we measured the effect of this intervention on mortality and duration of hospital stay.

## Methods

### Design and Patients

This is a multicenter, randomized, double-blind, placebo-controlled trial. The 4 participating hospitals were Erasmus University Medical Center (Rotterdam, 1300 beds), University Medical Center St. Radboud (Nijmegen,

 

***Context***

Topically applied mupirocin can eradicate nasal carriage of *Staphylococcus aureus*, but can it prevent *S. aureus* infections in nonsurgical, hospitalized patients?

***Contribution***

In this large double-blind trial, medically ill, hospitalized patients with positive nasal culture results for *S. aureus* were randomly assigned to either mupirocin or placebo nasal ointment twice daily for 5 days and were followed until 6 weeks after discharge. *Staphylococcus aureus* infection rates were similar among patients given mupirocin (2.6%) and placebo (2.8%).

***Implications***

Applying intranasal mupirocin ointment to patients who carry *S. aureus* in the nose did not prevent *S. aureus* infections in hospitalized, nonsurgical patients.

*–The Editors*

950 beds), VU University Medical Center (Amsterdam, 730 beds), and Amphia Hospital, Langendijk (Breda, 500 beds). The first 3 hospitals are tertiary care hospitals, and all are teaching hospitals in the Netherlands. The institutional review board of each hospital approved the study.

Between 1 February 1999 and 1 February 2001, adult patients hospitalized in nonsurgical departments were screened for nasal *S. aureus* carriage at the time of admission. All patients whose screening cultures grew *S. aureus* within 72 hours after admission were eligible for the study. Additional inclusion criteria were age 18 years or older, not being discharged or expected to be discharged within 1 day, not being transferred to a nonparticipating department, and provision of written informed consent. Exclusion criteria were known allergy to mupirocin or glycerin ester, presence of a nasal tube, recent or current mupirocin use (mostly patients undergoing hemodialysis or peritoneal dialysis), and any culture-proven *S. aureus* infection at the time of inclusion.

Trial participants were randomly assigned to receive mupirocin 2% nasal ointment or placebo ointment (both were obtained from GlaxoSmithKline, Harlow, United Kingdom) twice daily for 5 days. Mupirocin and placebo ointments were similar in appearance and odor and were supplied in identical tubes. Randomization was performed by a computer-generated allocation list and stratified for each hospital. The allocation list and study medication were stored by the departments of medical microbiology and infectious diseases at the participating centers. Study personnel and patients were blinded throughout the study. Study medication was dispensed by trained study personnel, who performed the first application according to the manufacturer's instructions. Subsequent applications were done by the patient or nursing personnel according to oral and written instructions. Patients and nurses were informed about possible adverse events (mainly local irritation, itching or burning, rhinorrhea, and, rarely, hypersensitivity reactions). They were instructed to report any adverse event related to the treatment, and medication was withdrawn if necessary. Patients did not receive follow-up cultures to check for clearance of *S. aureus* nasal carriage.

### Follow-up and Definitions

At randomization, the following patient data were collected: demographic characteristics, main diagnosis, underlying illnesses, immunosuppressive and antibiotic medication, and presence of indwelling devices or prosthetic material. The main diagnosis was coded according to the International Classification of Diseases, Ninth Revision (ICD-9).

Nosocomial *S. aureus* infections were followed up by checking the microbiological culture data from any site of all included patients on a weekly basis until 6 weeks after discharge. In case of a positive culture result, hospital records were checked and, if necessary, the treating physician was interviewed. Nosocomial infections were defined according to criteria of the Centers for Disease Control and Prevention (19). A nosocomial infection was caused by *S. aureus* when this pathogen was cultured from the site of infection. Patients with nosocomial *S. aureus* infection were considered to have sepsis if 2 or more of the following conditions were present: temperature greater than 38 °C or less than 36 °C; heart rate greater than 90 beats/min; respiratory rate greater than 20 breaths/min or $PaCO_2$ level less than 4.3 kPa; and leukocyte count greater than $12 \times 10^9$ cells/L or less than $4 \times 10^9$ cells/L; or greater than 10% immature (band) forms, according to standard criteria (20). Infections that were not clearly nosocomial were classified by an expert panel of 2 infectious disease specialists not related to the trial.

### Microbiology

Nasal swabs were collected by nursing personnel at admission. The swabs were streaked onto 5% sheep blood agar plates (Becton Dickinson, Le Pont de Claix, France), incubated for 48 hours at 35 °C, and checked each day for bacterial growth. Suspected colonies were identified as *S. aureus* with the Staphaurex Plus agglutination test (Abbott Murex, Chatillon, France). Patients with positive culture results were eligible for randomization. The identity of all positive isolates was later confirmed by an automated system (MicroScan Walk-a-Way, Dade-Behring, Inc., West Sacramento, California). Strains yielding negative results on confirmation were retested with the AccuProbe hybridization test (Gen-Probe, Inc., San Diego, California) according to the manufacturer's guidelines. Patients were incorrectly categorized as nasal carriers of *S. aureus* if the agglutination screening test result was positive but both the subsequent determination with the automated system and the hybridization test result were negative. Susceptibility to

mupirocin was tested only in strains causing infections and was performed by disk diffusion (21).

Infections were treated by the patients' physician, and treatment was not influenced by the trial team members. Cultures were processed according to standard microbiological methods. All *S. aureus* strains were stored in glycerol medium at −80 °C. Nasal and clinical *S. aureus* isolates from the same patient were genotyped by pulsed-field gel electrophoresis and were considered to be clonally related if their genotype patterns did not differ by more than 3 bands according to standard criteria (22).

### Sample Size and Statistical Analysis

On the basis of a literature review and prestudy data from the participating centers, we estimated a priori the incidence of nosocomial *S. aureus* infections among *S. aureus* nasal carriers to be 6% (9, 23). Thus, about 800 patients in each treatment group would demonstrate a statistically significant 50% reduction in nosocomial *S. aureus* infections in patients treated with mupirocin (with a power of 80% and an $\alpha$ level of 0.05).

The primary end point was the incidence of nosocomial *S. aureus* infections. Secondary outcome measures were time to nosocomial *S. aureus* infections, duration of hospitalization, and in-hospital mortality.

Data were analyzed by using SPSS 10.0 for Windows (SPSS Inc., Chicago, Illinois). The risks for nosocomial *S. aureus* infection and mortality in the 2 treatment groups were compared by estimating odds ratios, risk differences, and their 95% CIs per type of infection. Odds ratios with CIs not containing unity and risk differences with CIs not containing 0 were considered statistically significant. Differences per treatment group in duration of hospitalization and time to infection were tested for significance by the Mann–Whitney test. Other categorical variables were compared by Pearson chi-square or Fisher exact test where appropriate. Variables that differed between the 2 treatment groups by univariate analysis ($P < 0.1$) were included in a logistic regression model. A $P$ value less than 0.05 was considered statistically significant.

Data were analyzed on an intention-to-treat and per-protocol basis. The intention-to-treat analysis contained all randomly assigned patients fulfilling the inclusion criteria. The per-protocol analysis excluded the following patients: those with false-positive diagnoses of *S. aureus* carriership, those who did not complete the treatment course, and those who developed nosocomial *S. aureus* infection before the end of their prophylactic course.

### Role of the Funding Source

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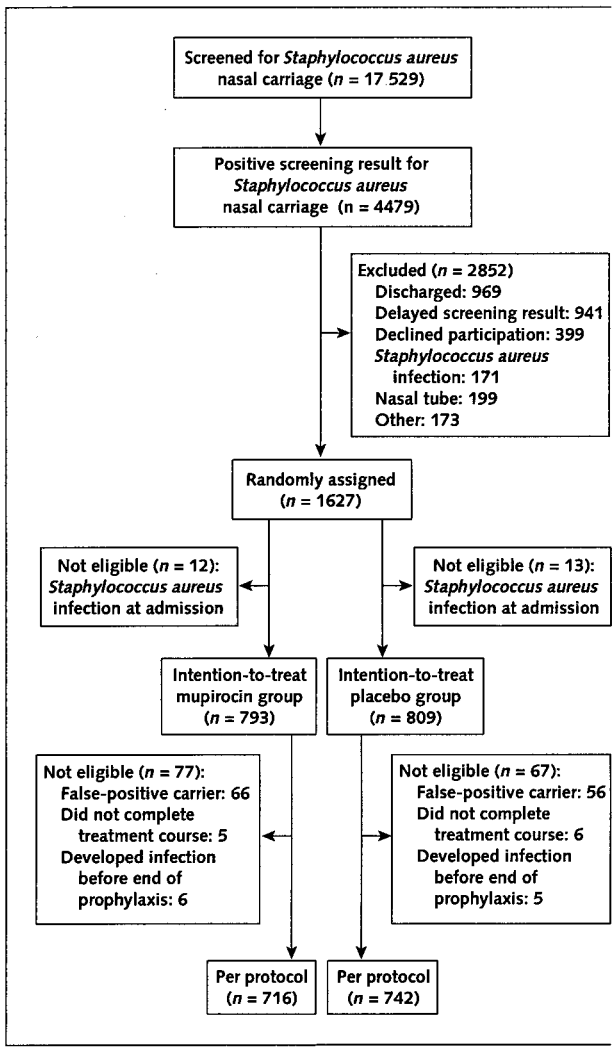
*Figure.* **Study profile.**




## RESULTS

### Enrollment

A total of 17 529 nonsurgical patients were screened for nasal carriage of *S. aureus*. Of these patients, 4479 (25.6%) patients were found to have *S. aureus* nasal carriage and 1627 were initially randomly assigned (**Figure**). There were 627 patients randomly assigned at Erasmus Medical Center, 462 patients randomly assigned at the University Medical Center St. Radboud, 126 patients randomly assigned at the VU University Medical Center, and 412 patients randomly assigned at the Amphia Hospital. The demographic characteristics of excluded patients did not differ from those of included patients (data not shown). In 25 patients hospitalized with an *S. aureus* infection, the culture results became known after randomization and these patients were excluded from analyses (**Figure**). Mupirocin was administered to 793 patients and placebo to 809 patients. Application commenced at a mean of 1.8 days (range, 1 to 3 days) after admission.

*Table 1.* **Patient Characteristics**

| Characteristic | Mupirocin Group (*n* = 793) | Placebo Group (*n* = 809) |
|---|---|---|
| Mean (±SD) age, *y* | 57.6 ± 16.5 | 57.4 ± 17.3 |
| Men, *n (%)* | 456 (57.5) | 453 (56.0) |
| Hospitalized in intensive care unit, *n (%)* | 34 (4.3) | 53 (6.6) |
| Underlying illness, *n (%)* | | |
| Diabetes | 126 (15.9) | 137 (16.9) |
| Autoimmune disorder | 46 (5.8) | 56 (6.9) |
| Neoplasms | 136 (17.2) | 123 (15.2) |
| Obstructive pulmonary disease | 85 (10.7) | 99 (12.3) |
| Skin disease | 99 (12.5) | 117 (14.5) |
| HIV infection | 10 (1.3) | 8 (1.0) |
| Post-transplantation | 28 (3.5) | 14 (1.7) |
| Renal insufficiency | 35 (4.4) | 28 (3.5) |
| Liver function disorder | 80 (10.1) | 68 (8.4) |
| Medication, *n (%)* | | |
| Chemotherapy | 55 (7.0) | 65 (8.0) |
| Corticosteroids | 123 (15.6) | 126 (15.6) |
| Immunosuppressive therapy | 44 (5.6) | 32 (4.0) |
| Antibiotics | 107 (13.5) | 107 (13.3) |
| Foreign bodies or indwelling devices, *n (%)* | | |
| Central venous access | 15 (1.9) | 14 (1.7) |
| Implant | 98 (12.4) | 95 (11.8) |
| Urine catheter | 29 (3.7) | 29 (3.6) |
| Other indwelling device | 24 (3.0) | 26 (3.2) |

The demographic and clinical characteristics of the 2 treatment groups were similar (**Table 1**). In 24 patients (14 receiving placebo and 10 receiving mupirocin), obstacles to ointment application occurred. Eleven of these patients stopped the prophylaxis prematurely. Four of the 24 patients (2 of which used mupirocin ointment) reported side effects (itching or burning sensation of the nose). No serious adverse events were observed or reported.

### Intention-to-Treat Analysis

The overall cumulative incidence of nosocomial *S. aureus* infections was 21 of 793 (2.6%) in the mupirocin group and 23 of 809 (2.8%) in the placebo group (risk difference, 0.2 percentage point [95% CI, −1.5 to 1.9 percentage points]) (**Table 2**). In addition, in-hospital mortality (risk difference, −0.2 percentage point [CI, −1.9 to 1.5 percentage points]) and duration of hospitalization did not differ between treatment groups. In each group, 1 death could be directly related to a nosocomial *S. aureus* infection. In patients developing a nosocomial *S. aureus* infection, the median time to infection was 25 days for the mupirocin group and 12 days for the placebo group ($P = 0.28$). The multiple logistic regression showed that the following variables were independent risk factors for nosocomial *S. aureus* infections: male sex, being immunocompromised, and the presence of an indwelling device (**Table 3**). Sepsis was diagnosed in 94% of the patients with nosocomial *S. aureus* bacteremia and in 83% of patients with *S. aureus* pneumonia.

All strains causing nosocomial *S. aureus* infections were mupirocin sensitive. Another 1039 *S. aureus* nasal strains from this study sample were tested, and none was found to be mupirocin resistant. Only 1 nasal strain was methicillin resistant (prevalence, 0.06%). Genotyping of nasal and subsequent infection strains revealed that 34 of 44 (77.3%) of these strains were clonally related to the nasal strain (**Table 2**).

### Per-Protocol Analysis

In the per-protocol cohort, the overall cumulative incidence of nosocomial *S. aureus* infections was 14 of 716 (1.9%) in the mupirocin group and 18 of 742 (2.4%) in the placebo group (risk difference, 0.5 percentage point [CI, −1.1 to 2.1 percentage points]). There were no statistically significant differences in mortality (risk difference, −0.2 percentage point [CI, −2.1 to 1.6 percentage points]) or duration of hospitalization (**Table 2**). In patients developing nosocomial *S. aureus* infections, the median time to infection was 32 days in the mupirocin group and 13 days in the placebo group ($P = 0.02$). The same variables in the intention-to-treat analysis were used for logistic regression analysis. In this analysis, an indwelling device was the only independent risk factor (**Table 3**).

*Table 2.* **Study Outcomes and Corresponding Risk Differences**

| Outcome | Intention to Treat | | | Per Protocol | | |
|---|---|---|---|---|---|---|
| | Mupirocin (*n* = 793) | Placebo (*n* = 809) | Risk Difference* (95% CI) | Mupirocin (*n* = 716) | Placebo (*n* = 742) | Risk Difference* (95% CI) |
| Nosocomial *Staphylococcus aureus* infections, *n (%)* | | | | | | |
| All† | 21 (2.6) | 23 (2.8) | 0.2 (−1.5 to 1.9) | 14 (1.9) | 18 (2.4) | 0.5 (−1.1 to 2.1) |
| Bacteremia | 7 (0.9)‡ | 10 (1.2) | 0.4 (−0.7 to 1.5) | 4 (0.6) | 8 (1.1) | 0.5 (−0.5 to 1.6) |
| Pneumonia | 5 (0.6) | 1 (0.1) | −0.5 (−1.4 to 0.2) | 4 (0.6) | 1 (0.1) | −0.4 (−1.3 to 0.3) |
| Surgical site infection, *n (%)* | 5 (0.6) | 8 (1.0) | 0.4 (−0.6 to 1.4) | 4 (0.6) | 5 (0.7) | 0.1 (−0.8 to 1.1) |
| Skin or soft-tissue infection, *n (%)* | 2 (0.3) | 4 (0.5) | 0.2 (−0.5 to 1.0) | 0 | 4 (0.5) | 0.5 (−0.1 to 1.4) |
| Urinary tract infection, *n (%)* | 2 (0.3) | 0 | −0.3 (−0.9 to 0.3) | 2 (0.3) | 0 | −0.3 (−1.0 to 0.3) |
| In-hospital mortality, *n (%)* | 24 (3.0) | 23 (2.8) | −0.2 (−1.9 to 1.5) | 23 (3.2) | 22 (3.0) | −0.2 (−2.1 to 1.6) |
| Median hospitalization (interquartile range), *d*§ | 8 (5.0 to 14.0) | 8 (5.0 to 15.5) | | 8 (4 to 14) | 8 (5 to 16) | |

* CIs not containing 0 were considered significant. Differences are expressed as percentage points.
† Identical nasal and clinical isolates as determined by pulsed-field gel electrophoresis: overall, 34 of 44 (77.3%); bacteremia, 14 of 17 (82.4%); pneumonia, 6 of 6 (100%); surgical site infection, 9 of 13 (69.2%); skin or soft-tissue infection, 4 of 6 (66.7%); and urinary tract infection, 1 of 2 (50.0%).
‡ 1 patient had endocarditis.
§ Mann–Whitney test: intention to treat, $P > 0.2$; per protocol, $P = 0.19$.

## DISCUSSION

This study showed that screening for *S. aureus* nasal carriage on admission by routine culture and applying mupirocin in *S. aureus* carriers to prevent nosocomial *S. aureus* infections in nonsurgical patients is not an efficacious strategy. None of the risk differences for the different types of nosocomial infections and mortality indicated sufficient mupirocin effectiveness to merit treatment (risk difference for overall infection, 0.2 percentage point [CI, −1.5 to 1.9 percentage points]; risk difference for mortality, −0.2 percentage point [CI, −1.9 to 1.5 percentage points]; $P > 0.05$). We found that 82.4% of the bacteremic strains were clonally related to the nasal strain at admission, which confirms the results found by von Eiff and colleagues (7).

Although the rate of *S. aureus* nasal carriage found in this study (25.6%) is within the range described in the literature (19% to 55%), the incidence of nosocomial *S. aureus* infections was far lower than that estimated a priori (10).

The observed low incidence can be explained by the relatively small proportion of patients in intensive care in our study sample. Also, the national trend for shorter hospitalizations reduces the period at risk for nosocomial infections and increases the chance of missing nosocomial *S. aureus* infections (24). Furthermore, the few risks described in the literature are mainly based on patients in the intensive care unit, who are at a greater risk for infection (9, 23).

We detected nosocomial infections by checking the microbiology reports. This may not be optimal, although 1 study found this method to have a sensitivity of approximately 90% (25). We believe that we detected most of these infections, since *S. aureus* infections usually lead to clinically evident disease. Since the study was blinded, missed infections would be evenly distributed between the treatment groups. A nonsurgical patient population in general probably has a relatively low risk for nosocomial *S. aureus* infections. This is illustrated by the 1.2% incidence of nosocomial *S. aureus* bacteremia in a similar patient sample, which was found by von Eiff and colleagues (7). We found a similar incidence in our placebo group and thus conclude that our study did not have exclusion bias.

Two other randomized, controlled trials that studied the efficacy of mupirocin in a general surgical and an orthopedic patient sample have recently been published (8, 26). These studies also showed little to no efficacy of mupirocin prophylaxis. The general surgery study included both carriers and noncarriers who were randomly assigned to either mupirocin or placebo. Overall, 2.3% of mupirocin recipients and 2.4% of placebo recipients had *S. aureus* infections at surgical sites. Among the *S. aureus* nasal carriers, mupirocin-treated patients had statistically significantly fewer nosocomial *S. aureus* infections at any site (4.0%) than placebo-treated patients (7.7%; odds ratio, 0.49 [CI, 0.25 to 0.92]). However, prophylactic mupirocin did not statistically significantly reduce the rate of *S. aureus* infection at surgical sites (8). The orthopedic trial also included carriers and noncarriers receiving a surgical intervention (26). In this study, mupirocin did not reduce the rate of *S. aureus* infection at surgical sites (mupirocin, 3.8%; placebo, 4.7%) or the duration of hospital stay. In the mupirocin group, the rate of endogenous *S. aureus* infections was 5 times lower than that in the placebo group (relative risk, 0.19 [CI, 0.02 to 1.62]).

*Table 3.* **Independent Relationship of Possible Risk Factors for Nosocomial *Staphylococcus aureus* Infection***

| Variable | Odds Ratio (95% CI)† | |
|---|---|---|
| | Intention to Treat | Per Protocol |
| Sex | | |
| Men | 2.25 (1.12–4.53) | 1.9 (0.90–4.39) |
| Women | 1 | |
| Renal insufficiency | | |
| Present | 2.71 (0.97–7.57) | 2.93 (0.92–9.37) |
| Absent | 1 | |
| Solid tumor | | |
| Present | 1.65 (0.79–3.39) | 1.89 (0.82–4.39) |
| Absent | 1 | |
| Liver dysfunction | | |
| Present | 1.76 (0.77–3.99) | 1.84 (0.72–4.68) |
| Absent | 1 | |
| Immunocompromised | | |
| Present | 2.15 (1.13–4.09) | 1.61 (0.75–3.47) |
| Absent | 1 | |
| Indwelling device | | |
| Present | 3.41 (1.29–8.98) | 3.35 (1.04–10.81) |
| Absent | 1 | |
| Study medication | | |
| Mupirocin | 0.92 (0.50–1.70) | 0.77 (0.38–1.57) |
| Placebo | 1 | |

* Obtained by multiple logistic regression. Along with mupirocin prophylaxis vs. placebo, we included variables in the regression model that were significant ($P < 0.1$) in the univariate analysis and included skin disease as a confounder.
† CIs not containing unity were considered statistically significant.

In our study, the time to infection shifted by almost 2 weeks in the subgroup of patients with nosocomial *S. aureus* infection. Patients in the mupirocin group, who had a prolonged hospital stay, seemed to catch up in infection probability after this delay. This may be due to recolonization with *S. aureus* from extranasal sites several weeks after mupirocin prophylaxis was stopped. Several studies show that recolonization with *S. aureus* occurs in 38% to 43% of patients after 4 to 6 weeks after mupirocin application (11, 12, 27). The role of *S. aureus* carriage at extranasal sites (for example, throat, skin, and perineum) in recolonization after mupirocin treatment and in developing infections needs further study. *Staphylococcus aureus* present in a lesion (for example, exit site of an indwelling device) may not be eradicated by solely applying mupirocin to the nose. Topical mupirocin application to such sites may be needed to reduce nosocomial *S. aureus* infections, such as line-related sepsis in patients with tunneled, cuffed hemodialysis catheters (28).

To prevent recolonization, repetitive mupirocin application to patients with prolonged hospital stay may have

resulted in more efficacy of this prophylactic regimen, which is the case for patients undergoing dialysis (10). However, this would affect a small proportion of all patients, since 90% of the patients in this study were already discharged within 25 days. Also, many nosocomial *S. aureus* infections occur early after admission. These infections may not be preventable by nasal application of mupirocin given a few days after admission. Future studies should consider screening high-risk patients and starting prophylaxis before admission or using a rapid molecular-based screening method and treating carriers the same day.

Although we did not find mupirocin-resistant strains in our study, large-scale use might induce more mupirocin-resistant organisms in the sample (18). Therefore, future intervention trials should preferably focus on patients who are known *S. aureus* carriers and are at high risk for *S. aureus* infections, including immunocompromised patients and patients requiring indwelling devices, as shown by the regression analysis in this study. This analysis also suggests that *S. aureus* carriers who have chronic renal insufficiency without dialysis indication are at increased risk for *S. aureus* infection.

This study does not support the strategy of routine culture at admission and subsequent mupirocin application in *S. aureus* nasal carriers to prevent *S. aureus* nosocomial infection in a general nonsurgical population. Because more than 80% of nosocomial cases of *S. aureus* bacteremia are endogenous, strategies that can effectively and safely eliminate *S. aureus* carriage from relevant sites may still play an important role in preventing infections with this pathogen. We recommend continued effort in elucidating the mechanisms leading to *S. aureus* carriage and subsequent infection and ongoing development and testing of prophylactic strategies.

From Erasmus University Medical Center, Rotterdam, the Netherlands; University Medical Center St. Radboud, Nijmegen, the Netherlands; Amphia Hospital, Breda, the Netherlands; and VU University Medical Center, Amsterdam, the Netherlands.

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