

Pharmacy and Therapeutics Committee  
Mupirocin Use For Surgical Prophylaxis  
9/2003

Recommendations:

- The use of prophylactic nasal mupirocin is recommended for prevention of sternal wound infections after Open Heart Surgery.
- Mupirocin is administered intranasal the evening before, day of surgery and bid for 5 days post operative.

Findings:

- Nasal mupirocin calcium ointment (2%) is indicated for the eradication of nasal colonization by methicillin-resistant Staphylococcus aureus. Apply approximately one-half of the single-use tube of ointment into each nostril (0.25 grams/nostril) twice daily for 5 days. After application, the nostrils should be pressed together and released repeatedly for 1 minute to adequately distribute the ointment throughout the nares. (Prod Info Bactroban(R) Nasal, 1999).
- The prevalence of nasal carriage of Staphylococcus aureus is 25-30%.
- Mupirocin eliminates Staph aureus nasal carriage in 83%-99% of patients.
- Staph aureus is sensitive to mupirocin in > 95% of isolates.
- Re colonization occurred in 26% in one study.
- The cost of treatment of sternal wound infections was estimated to be: \$81,000 ± \$42,000 for deep sternal wound infections and \$10,000 for a superficial sternal wound infections.
- The CDC list Staph aureus nasal carriage as a risk factor for surgical site infections.
- Mupirocin is produced by a fermentation of Pseudomonas bacteria. It is very active against Staphylococcus, including methicillin resistant strains and streptococcus.
- The sensitivity of S aureus to Mupirocin in 100 consecutive patients who were cultured was 96.2% after 2.5 years of continual usage for surgical prophylaxis of cardiac surgery patients (approximately 1300 patients).

Infection Rate	Mupirocin	Placebo	Difference	Cost of Prophylaxis for 100 patients	Cost To Treat infection per 100 patients	Cost Savings per 100 patients Receiving Prophylaxis
Deep Sternal Wound	0.35%	1.21%	0.86%	\$5,486.40	\$69,544.99	\$64,058.59
Superficial Wound Infection	0.59%	1.51%	0.93%		\$9,662.76	\$9,662.76
					Total Savings	\$73,721.35

**Literature, list chronologically within categories:**

**Surgical Site Infections**

J Hosp Infect. 2002 Dec;52(4):281-7.

A clinical trial of mupirocin in the eradication of methicillin-resistant Staphylococcus aureus nasal carriage in a digestive disease unit. Dupeyron C, Campillo B, Bordes M, Faubert E, Richardet JP, Mangeney N. Laboratoire de Microbiologie, Hopital Albert Chenevier, Creteil, France.

catherine.dupeyron@ach.ap-hop-paris.fr

We assessed the incidence of nasal carriage of methicillin-resistant Staphylococcus aureus (MRSA) on admission, the rate of acquisition during the hospital stay and the relationship with subsequent infection in a digestive disease unit. The efficacy of a program of nasal carriage eradication with mupirocin was evaluated simultaneously. Over one year 484 patients were studied prospectively on admission for nasal and stool carriage of MRSA, then every week for nasal carriage. Nearly 70% (68.8%) of patients had chronic liver diseases. Nasal carriers were assigned to a five-day course of intranasal mupirocin ointment. One hundred and seventeen (24.2%) patients were MRSA positive, 57 (11.8%) of which were carriers on admission and 60 (12.4%) acquired carriage. Of these, 86 were treated with mupirocin with a success rate of 98.8% and 25.9% of them recolonized. Fourteen patients were retreated, to allow eradication in 71.4% of cases. Seventy percent of these became carriers again. One high-level mupirocin-resistant strain was isolated before treatment and seven during or after treatment. Hospital stay and stool carriage were independently associated with reacquisition (P = 0.0105 and P = 0.0462, respectively). Molecular analysis showed identity between the strains isolated from infection samples and from nasal swabs during the same week. For every patient who became recolonized, nasal strains isolated before and after eradication were the same in 70% of cases. Mortality during hospital stay was independently associated with age (P = 0.0081), MRSA nasal carriage (P = 0.02631), MRSA infection (P < 0.0001) and liver disease (P = 0.0017). This study did not show a change in the prevalence rate of infection in the unit during treatment with mupirocin. This treatment should only be attempted once due to the risk of emergence of high-level resistant strains. Copyright 2002 The Hospital Infection Society

Clin Infect Dis. 2002 Aug 15;35(4):353-8. Epub 2002 July

Surgical site infections in orthopedic surgery: the effect of mupirocin nasal ointment in a double-blind, randomized, placebo-controlled study.

Kalmeijer MD, Coertjens H, van Nieuwland-Bollen PM, Bogaers-Hofman D, de Baere GA, Stuurman A, van Belkum A, Kluytmans JA. Department of Pharmacy, Academic Medical Center, University of Amsterdam, 1100 DD Amsterdam, The Netherlands.

m.d.kalmeijer@amc.uva.nl

The objective of this study was to determine whether use of mupirocin nasal ointment for perioperative eradication of Staphylococcus aureus nasal carriage is effective in preventing the development of surgical site infections (SSIs). A randomized, double-blind, placebo-controlled design was used. Either mupirocin or placebo nasal ointment was applied twice daily to 614 assessable patients from the day of admission to the hospital until the day of surgery. Mupirocin was applied twice daily for  $\geq 2$  doses before surgery. Surgical prophylaxis: cefamandole 2 gm, 30-60 minutes preop and 1 gm 8 and 16 hours post op or if cephalosporin allergic clindamycin 600 mg at the noted times. All isolates were susceptible to cefamandole, clindamycin, and mupirocin. A total of 315 and 299 patients were randomized to receive Mupirocin and placebo, respectively. Eradication of nasal carriage was significantly more effective in the mupirocin group (eradication rate, 83.5% versus 21.8%). In the mupirocin group, the rate of endogenous S. aureus infections was 5 times lower than in the placebo group (0.3% and 1.7%, respectively; relative risk, 0.19; 95% confidence interval, 0.02-1.62). Mupirocin nasal ointment did not reduce the SSI rate (by S. aureus) or the duration of hospital stay.

Surgical Site Infections Rates with Artificial Implant Material (Hip, Knee, & Back)

	Mupirocin N=315	Placebo N=299
Nasal Carriage at Baseline	30.3% (95/315)	28.8% (86/299)
Nasal Carriage After Treatment	16.5% (15/91)	78.2% (61/78)
Eradication Rate	83.5% (76/91)	21.8% (17/78) p <0.05
SSI	3.8% (12/315)	4.7% (14/299)
Deep	0%	0.3% (1/299)
Superficial	3.8% (12/315)	4.3% (13/299)
Staphylococcus aureus SSI	1.6% (5/315)	2.7% (8/299)
<b>Endogenous Staph aureus SSI</b>	0.3% (1/315)	1.7% (5/299)
Non Staph aureus infections	2.2% (7/315)	2% (6/299)
Length of Stay	14.7 $\pm$ 7.3 days	15 $\pm$ 6.3

N Engl J Med. 2002 Jun 13;346(24):1871-7. Related Articles,

Intranasal mupirocin to prevent postoperative Staphylococcus aureus infections.

Perl TM, Cullen JJ, Wenzel RP, Zimmerman MB, Pfaller MA, Sheppard D, Twombly J, French PP, Herwaldt LA; Mupirocin And The Risk Of Staphylococcus Aureus Study Team. University of Iowa Colleges of Medicine and Public Health, Iowa City, USA.

**BACKGROUND:** Patients with nasal carriage of Staphylococcus aureus have an increased risk of surgical-site infections caused by that organism. Treatment with mupirocin ointment can reduce the rate of nasal carriage and may prevent postoperative S. aureus infections. **METHODS:** We conducted a *randomized, double-blind, placebo-controlled trial* to determine whether intranasal treatment with mupirocin reduces the rate of S. aureus infections at surgical sites and prevents other nosocomial infections. *Mupirocin applied twice daily for up to 5 days before the operative procedure.* **RESULTS:** Of 4030 enrolled patients who underwent general, gynecologic, neurologic, or cardiothoracic surgery, 3864 were included in the intention-to-treat analysis. Overall, 2.3 percent of mupirocin recipients and 2.4 percent of placebo recipients had S. aureus infections at surgical sites. Of the 891 patients (23.1 percent of the 3864 who completed the study) who had S. aureus in their anterior nares, 444 received mupirocin and 447 received placebo. Among the patients with nasal carriage of S. aureus, 4.0 percent of those who received mupirocin had nosocomial S. aureus infections, as compared with 7.7 percent of those who received placebo (odds ratio for infection, 0.49; 95 percent confidence interval, 0.25 to 0.92; P=0.02). **CONCLUSIONS:** Prophylactic intranasal application of mupirocin did not significantly reduce the rate of S. aureus surgical-site infections overall, but it did significantly decrease the rate of all nosocomial S. aureus infections among the patients who were S. aureus carriers. Note: Paired isolates were available from 39/89 patients who had surgical-site infections. Pulsed-field gel electrophoresis of samples demonstrated that the S. aureus strain isolated from the nares was identical to that isolated for the infected site.

	Mupirocin		Placebo	
	All Patients N=1933	S. aureus Carriers N=444	All Patients N=1931	S. aureus Carriers N=447
Preoperative Nasal Carriage	23%	100%	23.1%	100%
Postoperative nasal Carriage	4.6%	16.6% (73/441)	21.3%	72.6% (323/445)
Eradication Rate**		83.4%		27.4%
Nosocomial Infection	11.3%	12.8% (57/444)	11.4%	16.1% (72/447)
Nosocomial S. aureus Infection	2.4%	4% (17/430)	2.9%	7.7% (34/439) p=0.02
Surgical Site Infection	7.9%	9.9% (44/444)	8.5%	11.6% (52/447)
S. aureus surgical site infection	2.3%(43/1892)	3.7% (16/432)	2.4% (46/1894)	5.9% (26/439)
Adverse Effects Rhinorrhea at application site	4.8%		4.8%	
Withdrew from study due side effect	1		4	

\*Includes Staph aureus infections of bloodstream, respiratory tract, and surgical site.

\*\* Clearance of nasal carriage was 81% 3-5 doses of mupirocin and 93.3% after six of more doses of mupirocin.

Ann Thorac Surg. 2001 May;71(5):1572-8; discussion 1578-9.

Intranasal mupirocin reduces sternal wound infection after open heart surgery in diabetics and nondiabetics.

Cimochowski GE, Harostock MD, Brown R, Bernardi M, Alonzo N, Coyle K. Department of Cardiac Surgery, Wilkes-Barre General Hospital, Pennsylvania, USA.

**BACKGROUND:** This study was designed to determine whether decreasing nasal bacterial colonization by applying Mupirocin (MPN) intranasally decreases sternal wound infections. **METHODS:** We prospectively followed 992 consecutive open heart surgery (OHS) patients who did not receive MPN prophylaxis (group I) from January 1, 1995 to October 31, 1996. Group II consisted of 854 consecutive patients followed prospectively from December 1, 1997 to March 31, 1999 treated with intranasal MPN given on the evening before, the morning of OHS, and twice daily for 5 days postoperatively. Surgical prophylaxis: Cefuroxime 1.5 gm 1 hour preop and q12h post op for 48 hours. If allergic, clindamycin was given 600 mg preop and q6h for 48 hours postoperative. **RESULTS:** There was a significant difference in the rate of overall sternal wound infections between the untreated (group I) and the treated group (group II): 2.7% (27 of 992) versus 0.9% (8 of 854) ( $p = 0.005$ ). The difference was also significant in the diabetic subgroup: 5.1% (14 of 277) (group I) versus 1.9% (5 of 266) (group II) ( $p = 0.04$ ) and the nondiabetic group: 1.8% (13 of 715) (group I) versus 0.5% (3 of 588) (group II) ( $p = 0.03$ ). The cost of MPN treatment was \$12.47 per patient compared with \$81,018 +/- \$41,567 for a deep wound infection with no antibiotic-related complications recorded. **CONCLUSIONS:** Prophylactic intranasal MPN is safe, inexpensive, and very effective in reducing the overall sternal wound infections by 66.6%. Note: At an average time of 45 days post Mupirocin treatment, 87% of patients had not recolonized the nares with *S aureus*. The sensitivity of *S aureus* to Mupirocin in 100 consecutive patients who were cultured poststudy was 96.2% after 2.5 years of continual usage.

	Control Group N=922	Control Group Average Post- Op Length of Stay (Days)	Intervention Group N= 854	Control Group Average Post- Op Length of Stay (Days)
Preoperative Nasal Carriage	19%		20.7%	
Total Sternal Wound Infection	2.7% (27/992)	38.4	0.9% (8/854) $p=0.005$	12.1 $P=0.004$
Deep Sternal Wound Infection	1.2% (12/992)	62.3	0.4% (3/854) $p=0.04$	17.7 $p=0.03$
Superficial Sternal Wound Infection	1.5% (15/992)	19.3	0.6% (5/854) $p=0.05$	8.8 $p=0.02$
DM	N=277		N=266	
Sternal Wound Infection	5.1% (14/277)		1.9% ( 5/266) $p=0.04$	
Non Diabetic	N=715		N=588	
Sternal Wound Infection	1.8% (13/715)		0.5% (3/588) $p=0.03$	
Mortality SWI	11.1%		0% $p=0.32$	

Infect Control Hosp Epidemiol. 1996 Dec;17(12):780-5.

Comment in: Infect Control Hosp Epidemiol. 1996 Dec;17(12):775-9.

Reduction of surgical-site infections in cardiothoracic surgery by elimination of nasal carriage of *Staphylococcus aureus*.

Kluytmans JA, Mouton JW, VandenBergh MF, Manders MJ, Maat AP, Wagenvoort JH, Michel MF, Verbrugh HA. Department of Clinical Microbiology, University Hospital Rotterdam, The Netherlands.

**OBJECTIVE:** To test the hypothesis that perioperative elimination of nasal carriage of *Staphylococcus aureus* using mupirocin nasal ointment reduces the surgical-site infection (SSI) rate in cardiothoracic surgery. **DESIGN:** Unblinded intervention trial with historical controls. **SETTING:** A university hospital, tertiary referral center for cardiothoracic surgery. **PATIENTS:** Consecutive patients undergoing cardiothoracic surgery between August 1, 1989, and February 1, 1991 (historical control group), and between March 1, 1991, and August 1, 1992 (intervention group). **RESULTS:** The historical control group consisted of 928 patients and the intervention group of 868, of whom 752 actually were treated. The 116 patients who were unintentionally not treated were considered as a concurrent control group. In the intention-to-treat analysis, a significant reduction in SSI rate was observed after the intervention (historical-control group 7.3% and intervention group 2.8%;  $P < .0001$ ). The SSI rate in the concurrent control group was significantly higher than in the treated group (7.8% and 2.0%, respectively;  $P = .0023$ ). Resistance of *S aureus* to mupirocin was not observed. **CONCLUSION:** The results of this study indicate that perioperative elimination of nasal carriage using mupirocin nasal ointment significantly reduces the SSI rate in cardiothoracic surgery patients and warrants a prospective, randomized, placebo-controlled efficacy trial. This preventive measure may be beneficial in other categories of surgical patients as well.

Surgical Site Infection Rate						
	Historical Controls N=928			Treated N=752		
	SSI	DSSI	ISSI	SSI	DSSI	ISSI
Mupirocin Susceptible <i>Staph aureus</i>	2.9%	1.9%	1%	0.9%	0.3%	0.7%
Coag. Negative <i>Staph</i>	1.5%	1%	0.5%	0.5%	0.4%	0.1%
Total	4.4%	2.9%	1.5%	1.4%	0.7%	0.8%
Mupirocin* Resistant Species	1.7%	0.8%	1%	0.4%	0.1%	0.3%
No Pathogen Isolated	1.1%	0.3%	7.5%	0.1%	0%	0.1%
Grand Total	7.3%	4%	3.3%	2%	0.8%	1.2%

Includes aerobic g(-) rods, *Pseudomonas aeruginosa*, and other isolates.

Infect Control Hosp Epidemiol. 1996 Dec;17(12):786-92.

Comment in: Infect Control Hosp Epidemiol. 1996 Dec;17(12):775-9.

Cost-effectiveness of perioperative mupirocin nasal ointment in cardiothoracic surgery.

VandenBergh MF, Kluytmans JA, van Hout BA, Maat AP, Seerden RJ, McDonnel J, Verbrugh HA.

Department of Clinical Microbiology, University Hospital, Rotterdam, The Netherlands.

**OBJECTIVE:** To assess the cost-effectiveness of perioperative intranasal application of mupirocin calcium ointment in cardiothoracic surgery. **DESIGN:** Cost-effectiveness analysis based on results of an intervention study with historical controls. **SETTING:** University Hospital Rotterdam, a tertiary referral center for cardiac and pulmonary surgery. **PATIENTS:** Consecutive patients undergoing cardiothoracic surgery between August 1, 1989, and February 1, 1991 (control group,  $n = 928$ ), and between March 1, 1991, and August 1, 1992 (intervention group,  $n = 868$ ). **INTERVENTION:** Perioperative nasal application of mupirocin calcium ointment started on the day before surgery, continued for 5 days, twice daily. **RESULTS:** Postoperative costs were increased significantly in patients with a surgical-site infection (SSI), compared with uninfected patients ( $P < .001$ ). Mean SSI-attributable costs were estimated at \$16,878 (95% confidence interval, \$15,575-\$18,181). The incidence of SSIs was 7.3% in the control group and 2.8% in the intervention group, mupirocin effectiveness being 62%. The costs of mupirocin were \$11 per patient. Thus, the savings per SSI prevented were \$16,633. To validate this comparative estimate of SSI-attributable costs, a noncomparative analysis of the postoperative length of stay (POLS) was performed, according to the Appropriateness Evaluation Protocol. Approximately 50% of the comparative SSI-attributable POLS were judged SSI-attributable in the noncomparative analysis. Sensitivity analyses, testing for the robustness of our conclusions, indicated that the presented model is rather insensitive to variations in the incidence of SSIs and for the effectiveness and costs of mupirocin. SSI-attributable costs were shown to be the only variable with substantial effect on the cost-effectiveness ratio. Perioperative mupirocin would result in net costs instead of savings only if SSI-attributable costs were less than \$245. **CONCLUSIONS:** SSIs in patients undergoing cardiothoracic surgery are associated with a substantial increase in postoperative costs. Provided that perioperative mupirocin reduces the SSI rate, this measure will be highly cost-effective in most centers providing cardiothoracic surgical services.

## Dialysis Catheters

Nephrol Dial Transplant. 2002 Oct;17(10):1802-7. Related

A randomized controlled trial of topical exit site mupirocin application in patients with tunnelled, cuffed haemodialysis catheters. Johnson DW, MacGinley R, Kay TD, Hawley CM, Campbell SB, Isbel NM, Hollett P. Department of Renal Medicine, Princess Alexandra Hospital, Brisbane, Australia. david\_johnson@health.qld.gov.au

**BACKGROUND:** Central venous catheters are frequently needed for the provision of haemodialysis, but their clinical usefulness is severely limited by infectious complications. The risk of such infections can be reduced by topical application of mupirocin to the exit sites of non-cuffed catheters or by the use of tunnelled, cuffed catheters. Whether mupirocin offers any additional protection against infection in patients with tunnelled, cuffed haemodialysis catheters has not been studied. **METHODS:** *An open-label, randomized controlled trial* was performed comparing the effect of thrice-weekly exit site application of mupirocin (mupirocin group) vs no ointment (control group) on infection rates and catheter survival in patients receiving haemodialysis via a newly inserted, tunnelled, cuffed central venous catheter. All patients were followed until catheter removal and were monitored for the development of exit site infections and catheter-associated bacteraemias. **RESULTS:** Fifty patients were enrolled in the study. Both the mupirocin (n=27) and control (n=23) groups were similar at baseline with respect to demographic characteristics, comorbid illnesses and causes of renal failure. Compared with controls, mupirocin-treated patients experienced significantly fewer catheter-related bacteraemias (7 vs 35%,  $P < 0.01$ ) and a longer time to first bacteraemia (log rank score 8.68,  $P < 0.01$ ). The beneficial effect of mupirocin was entirely attributable to a reduction in staphylococcal infection (log rank 10.69,  $P = 0.001$ ) and was still observed when only patients without prior nasal *Staphylococcus aureus* carriage were included in the analysis (log rank score 6.33,  $P = 0.01$ ). Median catheter survival was also significantly longer in the mupirocin group (108 vs 31 days, log rank score 5.9,  $P < 0.05$ ). Mupirocin use was not associated with any adverse patient effects or the induction of antimicrobial resistance. **CONCLUSIONS:** Thrice-weekly application of mupirocin to tunnelled, cuffed haemodialysis catheter exit sites is associated with a marked reduction in line-related sepsis and a prolongation of catheter survival.

J Antimicrob Chemother. 1999 Jan;43(1):105-12. Related

Cost-effectiveness of prophylactic nasal mupirocin in patients undergoing peritoneal dialysis based on a randomized, placebo-controlled trial.

Davey P, Craig AM, Hau C, Malek M. Medicines Monitoring Unit, University of Dundee, UK. [p.davey@dundee.ac.uk](mailto:p.davey@dundee.ac.uk)

The study objective was to measure the benefits of elimination of nasal carriage of *Staphylococcus aureus* by calcium mupirocin ointment in patients undergoing continuous ambulatory peritoneal dialysis. The design was a *prospective, placebo-controlled, randomized clinical trial*. The subjects were 267 patients recruited from nine renal units in Belgium, France and the UK. The main outcome measures were the rate of catheter exit site infection (ESI), rates of other infections and healthcare costs from the perspective of a hospital budget-holder. The rate of ESI caused by *S. aureus* was significantly reduced from one in 28.1 patient months to one in 99.3 patient months ( $P = 0.006$ ) and there were also non-significant trends towards lower rates of ESI caused by any organism and peritonitis caused by *S. aureus*. In comparison with the placebo group, patients in the mupirocin group with ESI had lower antibiotic ( $P = 0.02$ ) and hospitalization costs ( $P = 0.065$ ). However, overall costs of antibiotic treatment, for all infections combined, were not significantly different ( $P = 0.2$ ) and total antibiotic costs (including mupirocin) were significantly higher in the mupirocin group ( $P = 0.001$ ). Mupirocin prophylaxis would have been cost-neutral if the rate of ESI increased to  $>75\%$  in the placebo group, or if all healthcare costs increased by 40%, or if the cost of screening was reduced from Pound Sterling 15 to Pound Sterling 3 per patient, or if the cost of mupirocin treatment was reduced from Pound Sterling 93 to Pound Sterling 40 per patient year. In conclusion, savings in healthcare costs are unlikely to be sufficiently great to offset the cost of mupirocin and screening for nasal carriage of *S. aureus*. The decision about whether or not to implement mupirocin should depend on a local analysis of the value of preventing ESIs caused by *S. aureus*.

J Am Soc Nephrol. 1998 Jun;9(6):1085-92. Related Articles,

*Staphylococcus aureus* prophylaxis in hemodialysis patients using central venous catheter: effect of mupirocin ointment.

Sesso R, Barbosa D, Leme IL, Sader H, Canziani ME, Manfredi S, Draibe S, Pignatari AC.

Division of Nephrology, Universidade Federal de Sao Paulo, Escola Paulista de Medicina, Brazil.

Central venous catheterization is a common technique to establish rapid and temporary access for hemodialysis. However, it is a known risk factor for *Staphylococcus aureus* infection and bacteremia. Mupirocin is a topical antibiotic with high in vitro anti-staphylococcal activity. A *randomized prospective trial* was conducted to assess the effectiveness of mupirocin ointment in the prevention of *Staphylococcus aureus* skin and catheter colonization, and episodes of bacteremia in 136 end-stage renal disease patients. Of these, 67 received skin disinfection at the venous catheter insertion site with povidone iodine (control group), and 69 received the same treatment followed by application of 2% mupirocin ointment at the cannula site after catheter placement and at the end of each dialysis session. Patients were followed until catheter removal and were monitored for the development of *Staphylococcus aureus* skin/catheter colonization and episodes of bacteremia. Median duration of catheter use was greater in the mupirocin than in the control group (37 versus 20 d,  $P < 0.01$ ). Patients in the mupirocin group had a significantly lower rate of *Staphylococcus aureus* isolation from the pericatheter skin (1.76 per 1000 versus 14.27 per 1000 patient-days,  $P < 0.001$ ) and from the catheter surface (3.17 per 1000 versus 14.27 per 1000 patient-days,  $P < 0.001$ ). The proportion of patients with *Staphylococcus aureus* skin infection at the insertion site was lower in the mupirocin group (4.3% versus 23.9%,  $P = 0.001$ ). *Staphylococcus aureus*-associated bacteremia was observed in 17 patients (two in the mupirocin group [0.71 episodes per 1000 patient-days] and 15 in the control group [8.92 per 1000 patient-days],  $P < 0.001$ ). The hazard ratio of developing *Staphylococcus aureus* bacteremia was 7.2 (95% confidence interval, 1.6 to 31.6) times greater in patients not receiving mupirocin. Mupirocin applied to the insertion site significantly reduces the risk of

Staphylococcus aureus skin and catheter colonization, exit-site infection, and Staphylococcus aureus bacteremia in hemodialysis patients

Infect Control Hosp Epidemiol. 1996 Dec;17(12):809-11.

Nasal and cutaneous carriage of Staphylococcus aureus in hemodialysis patients: the effect of nasal mupirocin.

Boelaert JR, Van Landuyt HW, Gordts BZ, De Baere YA, Messer SA, Herwaldt LA. Unit of Renal and Infectious Diseases, Algemeen Ziekenhuis St Jan, Brugge, Belgium.

Fifteen of 20 hemodialysis patients who carried Staphylococcus aureus in their nares also carried the organism on their hands; 2 of 20 patients who did not carry S aureus in their nares carried S aureus on their hands ( $P < .001$ ). Eighty-seven percent of patients who carried S aureus in their nares and on their hands carried the same strain at both sites. Intranasal mupirocin eliminated S aureus from both sites.

Infect Control Hosp Epidemiol. 1996 Dec;17(12):793-7.

Elimination of nasal carriage of Staphylococcus aureus in hemodialysis patients.

Kluytmans JA, Manders MJ, van Bommel E, Verbrugh H. Department of Clinical Microbiology, University Hospital Rotterdam, The Netherlands.

**OBJECTIVE:** To study the efficacy of mupirocin for the elimination of nasal carriage of Staphylococcus aureus in hemodialysis patients. **DESIGN:** The efficacy of mupirocin was studied in a prospectively followed cohort. The effect of this intervention on the rate of S aureus bacteremia was evaluated using a historic control group. **SETTING:** Patients on the hemodialysis unit of the University Hospital Rotterdam, a tertiary referral center. **PATIENTS:** The study group consisted of consecutive patients on hemodialysis from February 1, 1992, until November 1, 1993. They were screened by taking nasal cultures monthly during their time on hemodialysis. If S aureus was isolated, treatment with mupirocin nasal ointment was initiated. The control group consisted of patients treated on the same hemodialysis unit from January 1, 1990, until January 1, 1992. **RESULTS:** The study group consisted of 226 patients, of whom 172 were evaluated to determine the efficacy of mupirocin. Sixty-seven (39%) were identified as nasal carriers. Following the initial treatment, 66 nasal cultures (98.5%) became negative. After 3 months and 6 months, respectively, 63 (94%) and 61 (91%) of the treated carriers had negative cultures. The rate of bacteremia (defined as the number of episodes of S aureus bacteremia per patient-year on hemodialysis) was significantly lower among the 226 patients in the study group (0.04 per patient-year) than among the 273 patients in the control group (0.25 per patient year,  $P < .001$ ). Development of resistance and adverse effects were not observed. **CONCLUSIONS:** Mupirocin nasal ointment effectively eliminates nasal carriage of S aureus in patients on hemodialysis. This was associated with a significant reduction of the incidence of S aureus bacteremia, as compared to historic controls.

J Am Soc Nephrol. 1996 Nov;7(11):2403-8. Related Articles,

Nasal mupirocin prevents Staphylococcus aureus exit-site infection during peritoneal dialysis. Mupirocin Study Group.

A total of 1144 patients receiving continuous ambulatory peritoneal dialysis in nine European centers was screened for nasal carriage of Staphylococcus aureus. Two hundred sixty-seven subjects (23.3%) were defined as carriers of S. aureus by having had at least two positive swab results from samples taken on separate occasions, and were randomly allocated to treatment or control groups. Members of each group used a nasal ointment twice daily for 5 consecutive days every 4 wk. The treatment group used calcium mupirocin 2% (Bactroban nasal; SmithKline Beecham, Welwyn Garden City, United Kingdom) and the control group used placebo ointment. Patients were followed-up for a maximum period of 18 months. There were 134 individuals in the mupirocin group, and 133 individuals acted as control subjects. There were no differences in demographic data, cause of renal failure, type of catheter, system used, or method of exit-site care between the groups. Similarly, there were no differences in patient outcome or incidence of adverse events between both groups. Nasal carriage fell to 10% in those subjects who received active treatment and 48% in those who used the placebo ointment. There were 55 exit-site infections in 1236 patient-months in the control group and 33 in 1390 patient-months in the treatment group (not significant). S. aureus caused 14 episodes of exit-site infection in the mupirocin group and 44 in the control group ( $P = 0.006$ , mixed effects Poisson regression model). There were no differences in the rate of tunnel infection or peritonitis. There was no evidence of a progressive increase in resistance to mupirocin with time. Regular use of nasal mupirocin in continuous ambulatory peritoneal dialysis patients who are nasal carriers of S. aureus significantly reduces the rate of exit-site infections that occurs because of this organism.

Am J Kidney Dis. 1996 May;27(5):695-700. Related Articles,

A randomized trial of Staphylococcus aureus prophylaxis in peritoneal dialysis patients: mupirocin calcium ointment 2% applied to the exit site versus cyclic oral rifampin.

Bernardini J, Piraino B, Holley J, Johnston JR, Lutes R. Renal-Electrolyte Division, University of Pittsburgh Medical Center, PA 15213, USA.

The objective of this study was to compare prophylaxis for Staphylococcus aureus infections in peritoneal dialysis patients using 600 mg cyclic oral rifampin for 5 days every 3 months versus mupirocin calcium ointment 2% applied daily to the exit site. The study design was a *prospective randomized trial*, controlling for S aureus nasal carriage. Eighty-two continuous ambulatory and continuous cyclic peritoneal dialysis patients (54% male, 71% white, 34% insulin-dependent, mean prestudy time on peritoneal dialysis 1.2 years) were randomly assigned to cyclic rifampin ( $n = 41$  patients) or daily exit site mupirocin prophylaxis ( $n = 41$  patients). Mean follow-up was 1 year. S aureus catheter infection rates were 0.13/yr with mupirocin and 0.15/yr with rifampin ( $P = NS$ ). Both rates

were significantly lower than the center's historical rate (the period between 1983 and 1992) of 0.46/yr prior to the study ( $P < 0.001$ ). *S aureus* peritonitis rates were 0.04/yr with mupirocin and 0.02/yr with rifampin ( $P = \text{NS}$ ), both significantly lower than the center's historical rate of 0.16/yr ( $P < 0.02$ ). Catheter loss due to *S aureus* infections was 0.02/yr with mupirocin and 0/yr with rifampin ( $P = \text{NS}$ ), both significantly lower than the center's historical rate of 0.12/yr ( $P < 0.001$ ). There were no side effects in patients using mupirocin, but 12% were unable to continue rifampin due to side effects. We conclude that mupirocin ointment at the exit site and cyclic oral rifampin are equally effective in reducing *S aureus* catheter infections. In addition, rifampin or mupirocin significantly reduced *S aureus* peritonitis and catheter loss due to *S aureus* infections. Mupirocin at the exit site provides an excellent alternative prophylaxis for *S aureus* infections, particularly in patients who cannot tolerate oral rifampin therapy.

ASAIO J. 1995 Jan-Mar;41(1):127-31. Related Articles, Links

Elimination of *Staphylococcus aureus* in hemodialysis patients.

Bommer J, Vergetis W, Andrassy K, Hingst V, Borneff M, Huber W. Department of Internal Medicine, University of Heidelberg, Germany.

*Staphylococcus aureus* infection and its complications are of great concern in the care of hemodialysis patients. Nasal contamination with *S. aureus* seems to be the main source of cutaneous contamination. The decontamination and recontamination of the skin of hemodialysis patients after using mupirocin nasal ointment was followed in a placebo control study. After 10 days of therapy with mupirocin nasal ointment, 25 of 33 (73%) patients were free of nasal *S. aureus* contamination in the nares control subjects 2 of 21, 10%). At the same time, the prevalence of positive skin cultures for *S. aureus* decreased from 30 of 33 (90%) to 11 of 33 (33%) patients. However, during the ensuing 130 days, 14 of 25 (58%) patients with negative nasal cultures became recontaminated, while the skin became recontaminated in 11 of 22 (50%) patients. In 10 of 14 *S. aureus* recontaminated patients the original *S. aureus* lysotype was documented by specific phage reaction. Four of fourteen patients had a new *S. aureus* lysotype. Mupirocin nasal ointment eradicated *S. aureus* transiently in 75% of the patients but continuously in only 11 of 33 (30%) patients.

J Hosp Infect. 1990 May;15(4):311-21. Related Articles, Links

Mupirocin for the reduction of colonization of internal jugular cannulae--a randomized controlled trial.

Hill RL, Fisher AP, Ware RJ, Wilson S, Casewell MW. Department of Medical Microbiology, King's College Hospital and School of Medicine & Dentistry, London, UK.

In a prospective study, 218 cardiothoracic patients, in whom 'Abbocath-T' cannulae had been inserted preoperatively into the internal jugular vein, were randomized to receive skin preparation of the insertion site with tincture of iodine (108 controls) or tincture of iodine followed by application of sterile 2% calcium mupirocin ointment (110 test patients). Cannulae were usually removed within 48 h of the operation. Patients receiving mupirocin were less likely to develop significant colonization of one or more of their cannulae as judged by Maki's criterion of a yield of greater than 15 colony forming units (cfu) from a cannula segment rolled on an agar plate (17% of mupirocin treated patients compared with 54% of the controls,  $P$  less than 0.001). Coagulase-negative staphylococci, micrococci, or both, were the commonest isolates and were cultured from 70% of the 186 control cannulae compared with 24% of 172 cannulae inserted through mupirocin-treated skin ( $P$  less than 0.001). A count of more than 15 cfu was found on the tips of 25% control cannulae compared with 5% of the cannulae from mupirocin-treated patients, an effect which was independent of in-situ time ( $P$  less than 0.001). For cannulae with colonized tips, the same species was isolated from the skin of the insertion site in 67%, from the exterior of the hub in 61% and from the lumen in only 15%. There were no side effects attributed to mupirocin or superinfection with resistant organisms. We conclude that in cardiothoracic patients the application of mupirocin after standard skin preparation with tincture of iodine significantly reduces the colonization of central venous cannulae by organisms derived from the skin insertion site.

"Pulse" nasal mupirocin maintenance regimen in patients undergoing continuous ambulatory peritoneal dialysis.

Mylotte JM, Kahler L, Jackson E. Department of Medicine, School of Medicine and Biomedical Sciences, State University of New York at Buffalo, USA.

**OBJECTIVE:** To determine, among patients undergoing continuous ambulatory peritoneal dialysis (CAPD) who were *Staphylococcus aureus* nasal carriers, if periodic brief "pulses" of nasal mupirocin calcium ointment 2% after completion of a mupirocin eradication protocol would maintain these patients free of carriage. **DESIGN:** *Noncomparative, nonblinded study with historical controls.*

**SETTING:** A county medical center. **PATIENTS:** Patients in a CAPD program during the period April 1996 to May 1998.

**METHODS:** All patients in the CAPD program had monthly nasal cultures for *S. aureus*. After informed consent, *S. aureus* nasal carriers were administered mupirocin to the nares twice a day for 5 days followed by nasal mupirocin twice monthly. Peritonitis and exit-site infection rates were monitored independently by CAPD nursing staff. Patients were monitored monthly for adverse effects of mupirocin and compliance with the maintenance regimen. **RESULTS:** Twenty-four patients in the CAPD program were enrolled in the study and had a median duration of follow-up of 8.5 months. Fifteen (63%) of the 24 patients remained free of nasal carriage on follow-up cultures. Of the 9 patients with positive nasal cultures during the study, 8 had only one positive culture. There was no significant difference in the mean yearly peritonitis rate or *S. aureus* peritonitis rate (January 1995-May 1998). However, there was a significant decrease in the mean yearly exit-site infection rates both overall (from 8.8 episodes per 100 patients dialyzed per month in 1995 to 4.0 in 1998;  $P = .008$ ) and due to *S. aureus* (from 5.6 in 1995 to 0.9 in 1998;  $P = .03$ ). Adverse effects of nasal mupirocin were mild overall; 1 patient was removed from the study due to an allergic reaction to mupirocin. **CONCLUSIONS:** Among CAPD patients who were *S. aureus* nasal carriers, periodic brief treatment with nasal mupirocin after an initial eradication regimen kept them free of carriage, for the most part, with few adverse effects. The pulse mupirocin regimen offers simplicity and possibly better compliance, as

well as minimizing exposure to this agent, thereby possibly reducing the risk of resistance. Further studies are warranted to compare this regimen to other commonly used mupirocin maintenance regimens in dialysis patients.

Nephrol Dial Transplant. 1989;4(4):278-81.

The influence of calcium mupirocin nasal ointment on the incidence of *Staphylococcus aureus* infections in haemodialysis patients. Boelaert JR, De Smedt RA, De Baere YA, Godard CA, Matthys EG, Schurgers ML, Daneels RF, Gordts BZ, Van Landuyt HW. Unit for Renal and Infectious Diseases, Algemeen Ziekenhuis t.-Jan, Brugge, Belgium.

Mupirocin was used in haemodialysis patients in an attempt to eradicate nasal carriage of *Staphylococcus aureus* and to prevent infection caused by this microorganism. The effectiveness of calcium mupirocin as a 2% nasal ointment OB2 (16 patients for 104 patient-months) was compared to that of placebo (18 patients for 147 patient-months) in a *double-blind study*. Mupirocin or placebo were applied in both anterior nares thrice daily for 2 weeks and subsequently three times weekly for a total of 9 months. During therapy, *S. aureus* was recovered from only 6% of the nasal cultures in the mupirocin group compared to 58% in the placebo group ( $P$  less than or equal to 0.01). Only one *S. aureus* infection was documented in the mupirocin group compared to six in the placebo group ( $P$  less than or equal to 0.05). The *S. aureus* strain causing the single infection in the mupirocin group was of a different phage type to that of the original nasal strain. In contrast, at least four of the six strains causing infection in the placebo group were of similar phage type to the original nasal strain. All *S. aureus* isolates remained mupirocin sensitive (MIC less than or equal to 1 mg/l). In conclusion, mupirocin nasal ointment was effective in eradicating nasal carriage of *S. aureus* and in preventing *S. aureus* infections in patients on haemodialysis.

### Nasal Carriage

Antimicrob Agents Chemother. 1999 Jun;43(6):1412-6.

Randomized, placebo-controlled, double-blind trial to evaluate the efficacy of mupirocin for eradicating carriage of methicillin-resistant *Staphylococcus aureus*.

Harbarth S, Dharan S, Liassine N, Herrault P, Auckenthaler R, Pittet D. Infection Control Program, University Hospitals of Geneva, CH-1211 Geneva 14, Switzerland.

Mupirocin has been widely used for the clearance of nasal methicillin-resistant *Staphylococcus aureus* (MRSA) carriage during outbreaks, but no placebo-controlled trial has evaluated its value for eradicating MRSA carriage at multiple body sites in settings where MRSA is not epidemic. In a 1,500-bed teaching hospital with endemic MRSA, 102 patients colonized with MRSA were randomized into a double-blind, placebo-controlled trial and treated with either mupirocin (group M) or placebo (group P) applied to the anterior nares for 5 days; both groups used chlorhexidine soap for body washing. Follow-up screening, susceptibility testing, and genotyping were performed to evaluate treatment success, mupirocin or chlorhexidine resistance, and exogenous recolonization. At baseline, MRSA carriage was 60% in the nares, 38% in the groin, and 62% in other sites (skin lesions, urine). The MRSA eradication rate (all body sites) was 25% in group M (12 of 48 patients), compared to 18% in group P (9 of 50 patients; relative risk [RR], 0.72; 95% confidence interval [CI95], 0.33 to 1.55). At the end of follow-up, 44% of patients (19 of 43) were free of nasal MRSA in group M, compared to 23% (11 of 44) in group P (RR, 0.57; CI95, 0.31 to 1.04). Ten patients developed MRSA infections (three in group M and seven in group P). One mupirocin treatment failure was due to exogenous MRSA recolonization. No MRSA isolate showed chlorhexidine resistance or high-level mupirocin resistance; however, we observed an association ( $P = 0.003$ ) between low-level mupirocin resistance at study entry (prevalence, 23%) and subsequent treatment failure in both study arms. These results suggest that nasal mupirocin is only marginally effective in the eradication of multisite MRSA carriage in a setting where MRSA is endemic.

J Antimicrob Chemother. 1995 Mar;35(3):399-408. Related

A double-blind, randomized, placebo-controlled clinical trial to evaluate the safety and efficacy of mupirocin calcium ointment for eliminating nasal carriage of *Staphylococcus aureus* among hospital personnel.

Fernandez C, Gaspar C, Torrellas A, Vindel A, Saez-Nieto JA, Cruzet F, Aguilar L. Preventative Medicine Department, San Carlos University Hospital, Madrid, Spain.

Sixty-eight health care workers were enrolled in a double-blind clinical trial and randomized to receive either mupirocin calcium ointment or placebo, intranasally bid for 5 days. Nasal cultures were taken immediately before starting treatment, 1 and 2 during treatment, at the end of treatment, 3 days later, weekly for 1-5 weeks and then monthly for 2-6 months after treatment. Mupirocin eliminated nasal carriage with *Staphylococcus aureus* in 58% of subjects within two days and 86.7% subjects by the end of therapy compared to 9.4% subjects at the end of treatment with placebo ( $P < 0.001$ ). Post-treatment colonization rates of 43%, 56% and 67% were attained after 1 month, 2-4 and 6 months treatment with mupirocin respectively and recolonisation with the same strain of *S. aureus* that had been isolated before treatment was noted in 32%, 40% and 48%. No resistance to mupirocin developed and the drug was well tolerated. Mupirocin is safe and effective in suppressing nasal carriage of *S. aureus*.

Antimicrob Agents Chemother. 1995 Jan;39(1):175-9. Related

Comparative study of mupirocin and oral co-trimoxazole plus topical fusidic acid in eradication of nasal carriage of methicillin-resistant *Staphylococcus aureus*.

Parras F, Guerrero MC, Bouza E, Blazquez MJ, Moreno S, Menarguez MC, Cercenado E.

Department of Clinical Microbiology and Infectious Diseases, Hospital Gregorio Marañon, Madrid, Spain.

Mupirocin is a topically applied drug that is very active in the eradication of nasal carriage of methicillin-resistant *Staphylococcus aureus* (MRSA). However, studies designed to compare mupirocin treatment with other antimicrobial regimens are lacking. We therefore conducted an open, prospective, randomized, controlled trial to compare the efficacy and safety of mupirocin versus those of oral co-trimoxazole plus topical fusidic acid (both regimens with a chlorhexidine scrub bath) for the eradication of MRSA from nasal and extranasal carriers of MRSA. The eradication rates with mupirocin and co-trimoxazole plus fusidic acid at 2, 7, 14, 21, 28, and 90 days were 93 and of 93, 100 and 100, 97 and 94, 100 and 92, 96 and 95, and 78 and 71%, respectively, for nasal carriage. At 7, 14, and 28 days the eradication rates for extranasal carriage by the two regimens were 23 and 74, 83 and 76, and 45 and 69%, respectively. The efficacies and safety of both regimens were similar. The MRSA isolates were not resistant to the study drugs either at the baseline or at follow-up. These results suggest that mupirocin and co-trimoxazole plus fusidic acid, both used in conjunction with a chlorhexidine soap bath, are equally effective and safe for the eradication of MRSA from nasal and extranasal MRSA carriers. Mupirocin was easier to use but was more expensive

Arch Intern Med. 1994 Jul 11;154(13):1505-8. Related Articles,

Long-term efficacy of intranasal mupirocin ointment. A prospective cohort study of *Staphylococcus aureus* carriage.

Doebbeling BN, Reagan DR, Pfaller MA, Houston AK, Hollis RJ, Wenzel RP. University of Iowa College of Medicine, Iowa City.

**BACKGROUND:** We investigated the long-term effect of a single 5-day application of intranasal mupirocin calcium ointment on *Staphylococcus aureus* nasal and hand colonization. The subjects were 68 healthy volunteers who were health care workers with stable *S aureus* nasal carriage and who had participated in a randomized, double-blind placebo-controlled clinical trial of intranasal mupirocin ointment. **METHODS:** A 1-year prospective cohort study of *S aureus* nasal carriers after treatment with active drug or placebo was performed. Cultures were obtained from all subjects 6 and 12 months after therapy. All subjects returned for the 6-month visit; 63 (93%) were examined at 1 year. The major outcome measure was the relative proportion of any *S aureus* cultured at either site at 6 and 12 months. The *S aureus* isolates were typed by restriction endonuclease analysis of plasmid DNA and by antibiotic susceptibility tests; the similarity of nasal and hand isolate "fingerprints" was compared. **RESULTS:** At 6 months, nasal carriage was 48% in the treatment group vs 72% in controls (relative risk, 0.68; 95% confidence interval, 0.45 to 1.02;  $P = .054$ ); at 1 year, nasal carriage was 53% vs 76%, respectively (relative risk, 0.70; 95% confidence interval, 0.48 to 1.02;  $P = .056$ ). Hand carriage at 6 months was significantly reduced among mupirocin recipients relative to controls (15% and 48%;  $P = .04$ , adjusted for the baseline rate of hand carriage). Thirty-six percent of treated subjects were recolonized in the nares with a new strain at 1 year, whereas 34% had reisolation of the original strain after initially negative posttherapy cultures. During the year of follow-up, hand carriage was observed at least once in two thirds of the subjects. Nearly all of the hand isolates (87%) exactly matched the subjects' coincident nasal plasmid fingerprint and antibiogram type. **CONCLUSIONS:** A single brief treatment course of intranasal mupirocin was effective in reducing nasal *S aureus* carriage for up to 1 year. When *S aureus* was recovered after nasal decolonization, the new isolate was as likely to represent colonization with a new strain as reisolation of the original strain. *Staphylococcus aureus* hand carriage was significantly decreased 6 months after therapy, further implicating the nares as the primary reservoir site for hand carriage.

J Chemother. 1994 Apr;6 Suppl 2:11-7. Related Articles, Links

Nasal and hand carriage of *Staphylococcus aureus* in healthcare workers.

Doebbeling BN. University of Iowa College of Medicine, Veterans' Affairs Medical Center, Iowa City 52242.

Six double-blind, randomised placebo-controlled clinical trials in the United States have evaluated the elimination of *Staphylococcus aureus* carriage in healthcare workers with mupirocin ointment. Consistent data from the six centres demonstrated that calcium mupirocin ointment administered intranasally for five days is safe and effective in eliminating nasal carriage of *S. aureus*. Hand cultures were also performed at one centre, showing that hand carriage rates were significantly decreased 72 hours post-therapy and at six months. Additionally, molecular typing of all isolates obtained from the nares and hands found identical strains at both sites in the majority of subjects, implicating the nares as the primary reservoir of *S. aureus* colonisation.

Clin Infect Dis. 1993 Sep;17(3):466-74. Related Articles,

Elimination of *Staphylococcus aureus* nasal carriage in health care workers: analysis of six clinical trials with calcium mupirocin ointment. The Mupirocin Collaborative Study Group. Doebbeling BN, Breneman DL, Neu HC, Aly R, Yango BG, Holley HP Jr, Marsh RJ, Pfaller MA, McGowan JE Jr, Scully BE, et al.

Department of Internal Medicine, University of Iowa College of Medicine, Iowa City 52242-1081.

Six double-blind, independently randomized studies evaluated the efficacy and safety of calcium mupirocin ointment in eliminating nasal carriage of *Staphylococcus aureus* among health care workers. Healthy volunteers with stable nasal carriage of *S. aureus* ( $n = 339$ ) received either calcium mupirocin ointment ( $n = 170$ ) or an identical placebo ointment ( $n = 169$ ) intranasally for 5 days. Nasal carriage was eliminated 48-96 hours after completion of treatment in 130 (91%) of 143 evaluable volunteers receiving mupirocin but in only 8 (6%) of 142 evaluable volunteers receiving placebo. The 85% crude difference represents a 90% pooled (adjusted) estimate of the risk difference (95% confidence interval, 0.86-0.95) and a risk ratio of 16 ( $P < .0001$ ). This effect of treatment with mupirocin was observed consistently (risk ratio, 8-32) in all six centers. In addition, 96 of the 130 mupirocin-treated volunteers and 1 of the 8 placebo-treated volunteers who were culture-negative at the end of therapy remained free of *S. aureus* 4 weeks after treatment.

Adverse events in each treatment arm were mild and equally frequent. These data, consistent across six institutions, demonstrate that calcium mupirocin ointment administered intranasally for 5 days is safe and effective in eliminating stable nasal carriage of *S. aureus*.

Ann Intern Med. 1991 Jan 15;114(2):101-6. Related Articles, Links

Comment in: Ann Intern Med. 1991 Jan 15;114(2):162-4. Ann Intern Med. 1991 Jun 1;114(11):990-1. Ann Intern Med. 1991 May 15;114(10):911-2.

Elimination of coincident *Staphylococcus aureus* nasal and hand carriage with intranasal application of mupirocin calcium ointment. Reagan DR, Doebbeling BN, Pfaller MA, Sheetz CT, Houston AK, Hollis RJ, Wenzel RP.

University of Iowa College of Medicine, Department of Veterans Affairs Medical Center, Iowa City.

**OBJECTIVE:** To determine the safety and efficacy of mupirocin calcium ointment in the elimination of *Staphylococcus aureus* nasal and hand carriage in healthy persons. **DESIGN:** *A double-blind, placebo-controlled, randomized trial.* **SETTING:** Clinical research unit of a tertiary medical center. **SUBJECTS:** Health care workers with stable *S. aureus* nasal carriage. **INTERVENTIONS:** Subjects ( $n = 68$ ) were randomly assigned to receive either mupirocin or placebo intranasally twice daily for 5 days. **MEASUREMENTS AND MAIN RESULTS:** Cultures of the hands and nares were obtained at baseline and 72 hours after therapy. The nares were also cultured 1, 2, 4, and 12 weeks after therapy. Antimicrobial susceptibility testing and restriction endonuclease analysis of plasmid DNA were used to confirm strain identity. There were no serious side effects. Mupirocin decreased the frequency of *S. aureus* nasal carriage at each time interval: At 3 months, 71% of subjects receiving mupirocin remained free of nasal *S. aureus* compared with 18% of controls. This difference (53%; 95% CI; 26% to 80%) was significant ( $P$  less than 0.0001). Additionally, analysis of plasmid patterns showed that 79% of subjects in the mupirocin group were free of the initial colonizing strain at 3 months. The proportion of hand cultures positive for *S. aureus* in the mupirocin group after therapy was lower than in the placebo group (2.9% compared with 57.6%). This difference (53%; 95 CI, 30% to 80%) was significant, after adjustment for the frequency of hand carriage at baseline ( $P$  less than 0.0001). **CONCLUSIONS:** When applied intranasally for 5 days, mupirocin calcium ointment is safe and effective in eliminating *S. aureus* nasal carriage in healthy persons for up to 3 months and appears to have a corresponding effect on hand carriage at 72 hours after therapy.

J Antimicrob Chemother. 1986 Mar;17(3):365-72. Related

Elimination of nasal carriage of *Staphylococcus aureus* with mupirocin ('pseudomonic acid')--a controlled trial.

Casewell MW, Hill RL.

In a blind controlled trial 2% mupirocin ointment was applied four times a day for five days to the anterior nares of 32 healthy volunteers who were followed-up for at least five weeks. Mupirocin eliminated the persistent carriage of *Staphylococcus aureus* in all subjects within two days of starting mupirocin. Two weeks after the course *S. aureus* could not be detected, even in low numbers, in nose swabs from any of the 32 volunteers, and even after five weeks only six had resumed carriage. Of the 14 subjects who ultimately resumed carriage, 57% acquired a different phage type and 29% showed a relapse of colonisation with their pre-treatment strain. There was no evidence of overgrowth with Gram-negative organisms and pre- and post-treatment isolates of *S. aureus* were sensitive to mupirocin with MICs of 0.06 mg/l or less. There were no side-effects. We suggest that mupirocin may become the topical agent of choice for the elimination of *S. aureus* from the anterior nares.

## Misc

Eur J Emerg Med. 2001 Sep;8(3):203-14.

Reduction in gram-positive pneumonia and antibiotic consumption following the use of a SDD protocol including nasal and oral mupirocin.

Nardi G, Di Silvestre AD, De Monte A, Massarutti D, Proietti A, Grazia Troncon M, Lesa L, Zussino M.

Department of Anaesthesia, Azienda Ospedaliera S. Maria della Misericordia, Udine, Italy.

The objective of this prospective, randomized, double-blind study was to evaluate the effect of the addition of mupirocin to the 'classical' topical SDD regimen (tobramycin 80 mg, polymyxin E 100 mg, amphotericin B 500 mg) on the development of ICU-acquired infections due to gram-positive bacteria. The study was carried out in an intensive care unit (ICU) of a 1400-bed community hospital. All patients admitted to the ICU during a 16-month period, who were expected to require mechanical ventilation for more than 24 hours, were randomized to receive either the 'classical' SDD regimen (Group A) or a modified regimen with mupirocin (Group B). Data from 223 patients requiring mechanical ventilation for at least 48 hours, who were neither infected nor receiving antibiotics on ICU admission, was analysed. A 2% paste containing tobramycin, polymyxin E and amphotericin B was applied every 6 hours in the oropharynx to the patients in Group A, while in Group B this formula was modified with the addition of 2% mupirocin. In Group B 0.2 ml of a 2% mupirocin ointment was also applied four times daily in both nostrils. Patients in Group A received a soft paraffin ointment as a placebo indistinguishable from mupirocin. Patients in both groups received the classic SDD regimen through the nasogastric tube. Systemic antibiotic prophylaxis was not used. Data on lower airway infection, and blood infection, infections of intravascular catheters, antibiotic consumption and expenditures for antibiotics were analysed. The diagnosis of ventilator-associated pneumonia (VAP) was based on quantitative cultures of protected specimen brush samples (PSB) or on the results of distal bronchoalveolar lavage (BAL). One hundred and four patients received the 'classical' SDD and 119 the modified regimen. Overall 29 patients, 20 in Group A and nine in Group B ( $p < 0.02$ ) had a total of 33 cases of pneumonia. There were 23 episodes of pneumonia in Group A and 10 in Group B ( $p < 0.02$ ). Gram-positive bacteria were isolated from samples in 17 episodes in Group A and six in Group B ( $p < 0.02$ ). *Staphylococcus aureus* was isolated in nine cases of pneumonia in Group A and once in the 'mupirocin' group ( $p < 0.05$ ). MRSA were isolated in seven out of nine cases in Group A and in the only case in Group B. There were no differences in the isolation of gram-negative bacilli. Antibiotic consumption and cost were lower in Group B. In conclusion, our data show that the topical use of

a modified formula of SDD, with the addition of mupirocin to the oral paste and in the anterior nares, is associated with a reduction in lung infections caused by gram-positives and in a reduction in antibiotic consumption and in the overall expenditure for antibiotics.

Arch Intern Med. 1996 May 27;156(10):1109-12. Related Articles,

1-year trial of nasal mupirocin in the prevention of recurrent staphylococcal nasal colonization and skin infection.

Raz R, Miron D, Colodner R, Staler Z, Samara Z, Keness Y. Infectious Diseases Unit, Central Emek Hospital, Afula, Israel.

**BACKGROUND:** The usefulness of nasal mupirocin in preventing recurrent staphylococcal nasal colonization and skin infection has been examined in immunodeficient patients and in healthy staphylococcal carriers but not in immunocompetent staphylococcal carriers who experience recurrent skin infections. We studied 34 such patients. **METHODS:** After an initial 5-day course of nasal mupirocin ointment for all patients, 17 patients continued to apply a 5-day course of nasal mupirocin every month for 1 year, and the other 17 patients applied a placebo ointment. Nasal cultures were obtained monthly, and all episodes of skin infection were recorded. **RESULTS:** The overall number of positive nasal cultures was 22 in the mupirocin group and 83 in the placebo group ( $P < .001$ ), and the number of skin infections was 26 and 62, respectively ( $P < .002$ ). Eight of the 17 mupirocin-treated patients but only 2 in the placebo group remained free of positive staphylococcal nasal cultures. One of the 10 patients who were free of colonization during the 12-month treatment period had skin infections, in contrast to all 24 of the patients with positive cultures ( $P < .01$ ). Staphylococci resistant to mupirocin were observed in 1 patient. No adverse effects were reported. **CONCLUSIONS:** A monthly application of mupirocin ointment in staphylococcal carriers reduces the incidence of nasal colonization, which in turn lowers the risk of skin infection.

Am J Med. 1993 Apr;94(4):371-8. Related Articles, Links

Attempts to eradicate methicillin-resistant *Staphylococcus aureus* from a long-term-care facility with the use of mupirocin ointment.

Kauffman CA, Terpenning MS, He X, Zarins LT, Ramsey MA, Jorgensen KA, Sottile WS, Bradley SF.

Division of Infectious Diseases, Department of Veterans Affairs Medical Center, Ann Arbor, Michigan 48105.

**PURPOSE:** To assess the impact of the use of mupirocin ointment on colonization, transmission, and infection with methicillin-resistant *Staphylococcus aureus* (MRSA) in a long-term-care facility. **PATIENTS AND METHODS:** All 321 residents of a Veterans Affairs long-term-care facility from June 1990 through June 1991 were studied for MRSA colonization and infection. MRSA-colonized patients received mupirocin ointment to nares in the first 7 months and to nares and wounds in the second 5 months. The effect of mupirocin use on MRSA colonization and infection was monitored. All *S. aureus* strains isolated were tested for the development of resistance to mupirocin. **RESULTS:** A total of 65 patients colonized with MRSA received mupirocin ointment. Mupirocin rapidly eliminated MRSA at the sites treated in most patients by the end of 1 week. Weekly maintenance mupirocin was not adequate to prevent recurrences--40% of patients had recurrence of MRSA. Overall, MRSA colonization in the facility, which was 22.7% +/- 1% prior to the use of mupirocin, did not change when mupirocin was used in nares only (22.2% +/- 2.1%), but did decrease to 11.5% +/- 1.8% when mupirocin was used in nares and wounds. Although colonization decreased, roommate-to-roommate transmission and MRSA infection rates, low to begin with, did not change when mupirocin was used. Mupirocin-resistant MRSA strains were isolated in 10.8% of patients. **CONCLUSIONS:** Mupirocin ointment is effective at decreasing colonization with MRSA. However, constant surveillance was required to identify patients colonized at admission or experiencing recurrence of MRSA during maintenance treatment. Long-term use of mupirocin selected for mupirocin-resistant MRSA strains. Mupirocin should be saved for use in outbreak situations, and not used over the long term in facilities with endemic MRSA colonization.

J Hosp Infect. 1989 Aug;14(2):117-24. Related Articles, Links

Effect of mupirocin on nasal carriage of *Staphylococcus aureus*.

Bulanda M, Gruszka M, Heczko B. Department of Bacteriology, Medical Academy, Krakow, Poland.

Mupirocin eliminates nasal carriage of *Staphylococcus aureus* among medical and surgical personnel for periods varying from several weeks up to one year. In persons recolonized after therapy densities of *S. aureus* populations in nares were much lower than in the same persons before therapy.

## Micromedex Information

- ADULT:
  - a. Calcium mupirocin is indicated for the eradication of NASAL COLONIZATION with methicillin resistant staphylococcus aureus (MRSA) (Prod Info Bactroban(R) Nasal, 2000). Calcium mupirocin is 90% effective in eradicating nasal colonization, and evidence is mounting that calcium mupirocin may prevent autoinfection in some high risk patients, as well as reduce the chance the organism will spread from one individual to another (Bertino, 1997; Boyce, 1996; Doebbeling et al, 1994; Doebbeling et al, 1993; Scully et al, 1992; Hill & Casewell, 1990; Casewell & Hill, 1991; Lamb, 1991).
  - b. A randomized, placebo-controlled trial finds 5 day intranasal 2% mupirocin calcium ointment treatment significantly effective for Staphylococcus aureus eradication for several weeks in 30 (88%) HUMAN IMMUNODEFICIENCY (HIV) patients treated with mupirocin (n=34) compared with 3 (8%) placebo treated patients (n=36). Yet recolonization increased in the mupirocin group throughout follow-up and by week 10, 57% of patients had positive nasal cultures (Martin et al, 1999).
  - c. Mupirocin was found to be highly effective in eradicating the nasal carriage of Staphylococcus aureus in hemodialysis patients, significantly reducing the incidence of Staphylococcus aureus bacteremia. Although this study used a historical control group, the findings indicate that eradicating the nasal carriage of Staphylococcus aureus can reduce
  - staphylococcal bacteremia substantially (Kluytmans et al, 1996a). Another study demonstrated that intranasal mupirocin eliminated Staphylococcus aureus from both the nares and hands of hemodialysis patients (Boelaert et al, 1996).
  - d. Cardiothoracic surgery patients treated perioperatively with intranasal mupirocin calcium ointment had significantly fewer post-operative surgical-site infections (SSI) than historical controls that were not treated (Kluytmans et al, 1996). A separate study on this same group of patients found that the application of mupirocin to all patients undergoing cardiothoracic surgery would be cost-effective. A prospective, randomized, placebo-controlled trial is still needed before this should be recommended routinely (VandenBergh et al, 1996).
  - e. According to a review of observational studies, mupirocin effectively eliminates nasal colonization and controls methicillin-resistant Staphylococcus aureus (MRSA) outbreaks. Efficacy has been documented in not only teaching hospitals, but also in long-term care, urology, and neonatal intensive care units. MRSA documented cultures were eradicated by the end of therapy in at least 90% of patients in healthcare workers. Treatment duration ranged from 5 to 14 days. One study did find that reducing the application frequency from 4 to 2 times daily did not reduce the efficacy (Bertino, 1997).
  - f. In a placebo controlled double blind evaluation, mupirocin eradicated nasal carriage in Staphylococcus aureus in 78% of 70 evaluable patients at 4 weeks, after five days of treatment. Six cases of recolonization with mupirocin-resistant strains were reported (Scully et al, 1992).
  - g. In a placebo-controlled trial (n=68), mupirocin calcium ointment was safe and effective in eliminating Staphylococcus aureus nasal carriage in healthy subjects for up to 3 months. Subjects received either mupirocin or placebo intranasally twice daily for 5 days. At 3 months, 71% of subjects receiving mupirocin remained free of nasal Staphylococcus aureus compared with 18% of controls (Reagan et al, 1991).
  - h. A single 5-day treatment with mupirocin was effective in reducing nasal Staphylococcus aureus carriage for up to 1 year in a study enrolling 68 healthy, health-care workers. At 6 months, nasal carriage was 48% in the treatment group versus 72% in controls. At one year, nasal carriage was 53% in the treatment group versus 76% in the controls. In the treatment group, 30% remained free of nasal Staphylococcus aureus, 36% were colonized with a new strain, and 34% had re-isolation with the original strain after once being negative (Doebbeling et al, 1994).
  - i. Mupirocin eradicated nasal carriage of Staphylococcus aureus in 97% of 628 cases in an open evaluation (Redhead et al, 1991).
  - j. The Hospital Infection Society and British Society of Antimicrobial Chemotherapy has published recommendations for the control of epidemic methicillin-resistant Staphylococcus aureus which include the utilization of mupirocin to be applied to the anterior nares of nasal carriers for at least days (Aykuffe, 1986).
- 4. PEDIATRIC:
  - a. An outbreak of methicillin-resistant Staphylococcus aureus in low birth weight infants in a regional special care baby unit was successfully controlled with the use of topical mupirocin ointment. The drug was applied to the anterior nares and umbilicus twice a day along with the use of intensive traditional methods of infection control: skin cleaning with soap and water, umbilical cleaning with isopropyl alcohol, and topical hexachlorophene (Davies et al, 1987).