

Décolonisation du portage nasal à
Staphylococcus aureus
en chirurgie orthopédique :
où en sommes-nous en 2016 ?

Conflit d'intérêt

Aucun

Relation portage nasal *S. aureus* et infection du site opératoire due à cette bactérie ?

Eur J Clin Microbiol Infect Dis
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INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY

319

NASAL CARRIAGE OF *STAPHYLOCOCCUS AUREUS* IS A MAJOR RISK FACTOR FOR SURGICAL-SITE INFECTIONS IN ORTHOPEDIC SURGERY

Mathijs D. Kalmeijer, MSc, PharmD; Ella van Nieuwland-Bollen, ICP; Diane Bogaers-Hofman, ICP; Gerard A.J. de Baere, MD; Jan A.J.W. Kluytmans, PhD

TABLE 4
RISK FACTORS FOR SURGICAL-SITE INFECTION ([SSI] UNIVARIATE ANALYSIS)

Risk Factor	RR	CI ₉₅
Any SSI		
Male gender	4.1	1.5-10.9
Underlying illness	2.6	0.9-7.7
Removing hair with razor blade	2.4	0.5-11.3
Surgeon 1	3.4	1.3-8.8
<i>Staphylococcus aureus</i> nasal carriage (any)	2.3	0.8-6.4
<i>S aureus</i> nasal carriage (high level)	3.1	1.1-9.0
<i>S aureus</i> SSI		
Male gender	3.0	0.8-11.5
Underlying illness	4.4	1.1-17.0
Removing hair with razor blade	2.6	0.3-22.1
Surgeon 1	3.1	0.8-12.2
<i>Staphylococcus aureus</i> nasal carriage (any)	8.9	1.7-45.5
<i>S aureus</i> nasal carriage (high level)	16.0	3.1-82.2

Abbreviations: CI₉₅, 95% confidence interval; RR, relative risk.

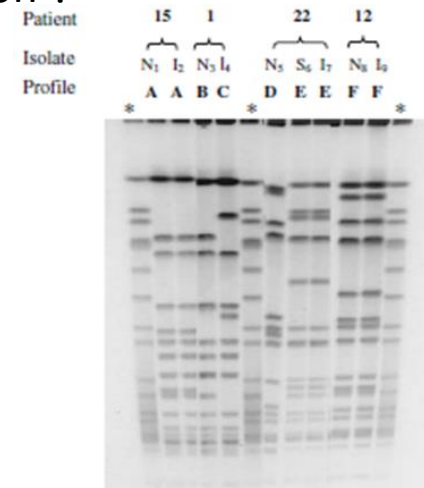
ARTICLE

Is nasal carriage of *Staphylococcus aureus* the main acquisition pathway for surgical-site infection in orthopaedic surgery?

P. Berthelot • F. Grattard • C. Cazorla • J.-P. Passot •
J.-P. Fayard • R. Meley • J. Bejuy • F. Farizon •
B. Pozzetto • F. Lucht

Portage nasal *S. aureus* = FR ISO MAIS

- Caractérisation portage nasal ?
- Autres sites colonisation ?
- Dynamique colonisation ?



Letter to the Editor

Staphylococcus aureus Screening and Decolonization in Orthopaedic Surgery and Reduction of Surgical Site Infections

Paul O. Verhoeven MD, MS, Philippe Berthelot MD, PhD, Celine Chapelle MS,
Julie Gagnaire PharmD, MS, Florence Grattard MD, PhD, Bruno Pozzetto MD, PhD,
Frédéric Farizon MD, PhD, Frederic Lucht MD, PhD, Elisabeth Botelho-Nevers MD, PhD

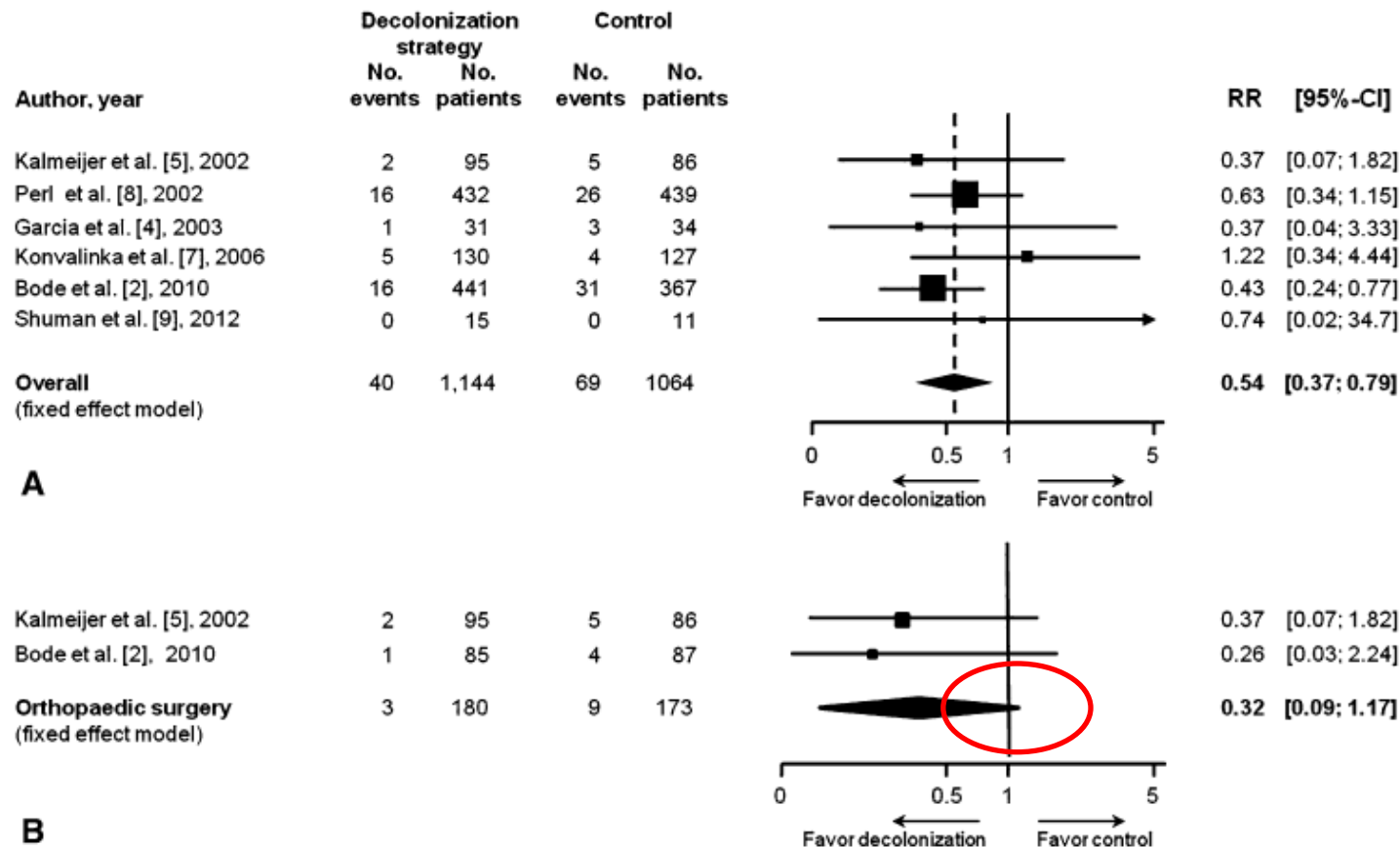


Fig. 1A–B (A) Postoperative *S. aureus* infections among *S. aureus* carriers with whom a decolonization strategy was used in all surgical procedures (B) Postoperative *S. aureus* infections among *S. aureus*

carriers with whom a decolonization strategy was used in a subgroup of orthopaedic surgery. (Reprinted with permission from Verhoeven and colleagues).



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ORIGINAL ARTICLE

Relation between nasal carriage of *Staphylococcus aureus* and surgical site infection in orthopedic surgery: The role of nasal contamination. A systematic literature review and meta-analysis



B. M. Lemaire^a, M. Ollivier^b, M. Drancourt^{a,b}, D. Raoult^a,
Odds ratio and 95% CI

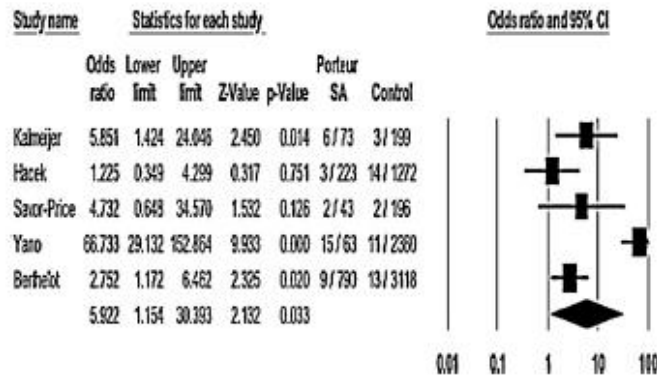


Figure 2 Effect of nasal *Staphylococcus aureus* surgical site infection. Point forest display. The last line corresponds to the summary effect on the random effects model: **OR = 5.92, 95% CI [1.15–30.39], P = 0.03.**

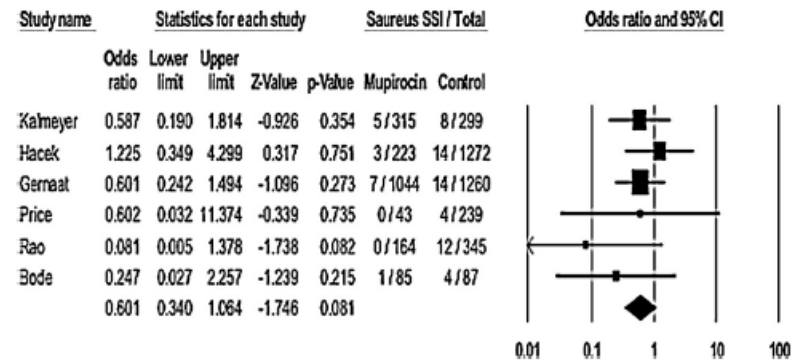


Figure 4 Effect of mupirocin on *Staphylococcus aureus* surgical site infection. Point forest display. Mupirocin: group receiving pre-operative mupirocin. Control: no preventive treatment. The last line corresponds to the summary effect on the random effects model: **OR = 0.60, 95% CI [0.34–1.06], P = 0.08.**



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ORIGINAL ARTICLE

Relation between nasal carriage of *Staphylococcus aureus* and surgical site infection in orthopedic surgery: The role of nasal contamination. A systematic literature review and meta-analysis



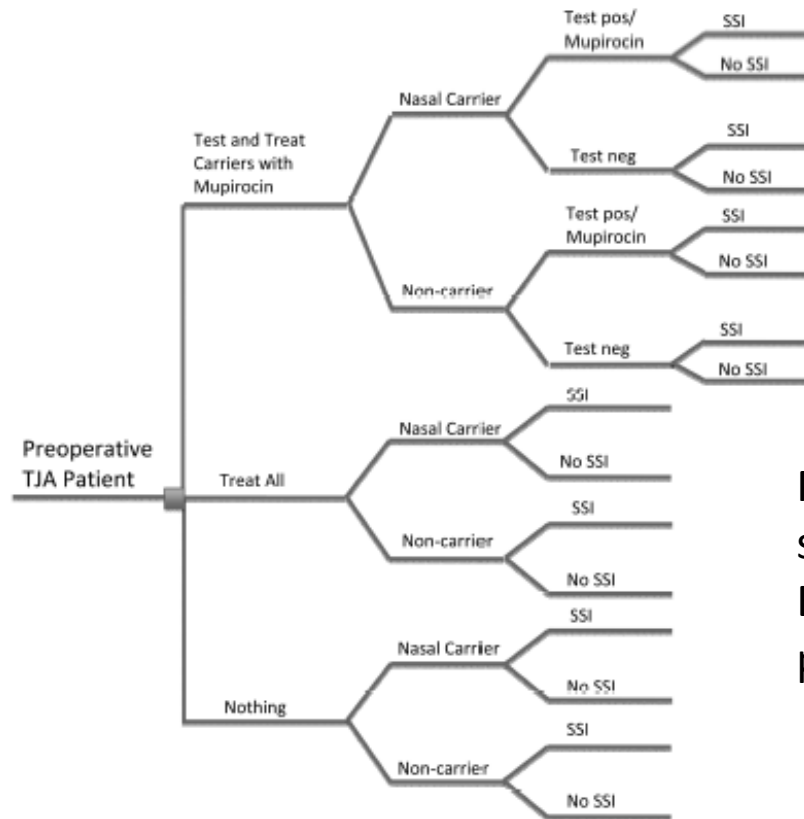
P.-Y. Levy^a, M. Ollivier^b, M. Drancourt^{a,b}, D. Raoult^a,
J.-N. Argenson^{b,*}

- there is established scientific evidence (grade A recommendation) that mupirocin is more effective than other agents in eradicating nasal *S. aureus* carriage [23–34];
- there is established scientific evidence (grade A recommendation) that 2% alcoholic chlorhexidine is more effective than aqueous iodized povidone in preventing superficial and deep infection [21,22];
- there is no established scientific evidence that mupirocin alone reduces the risk of orthopedic *S. aureus* SSI [17,18]: the cited studies report a sub-significant trend;
- there is, on the other hand, established scientific evidence (grade A recommendation) for a significant reduction in *S. aureus* SSI with associated mupirocin and 2% chlorhexidine antiseptic solution in case of positive nasal screening, but this significant reduction fails to hold for the orthopedic surgery subgroup [23].

ORIGINAL ARTICLE

Cost-Effectiveness of Preoperative Nasal Mupirocin Treatment in Preventing Surgical Site Infection in Patients Undergoing Total Hip and Knee Arthroplasty: A Cost-Effectiveness Analysis

Xan F. Courville, MD, MS;^{1,4} Ivan M. Tomek, MD, FRCS(C);¹ Kathryn B. Kirkland, MD;^{2,4} Marian Birhle, MPH;⁴
Stephen R. Kantor, MD;¹ Samuel R. G. Finlayson, MD, MPH^{3,4}



Infect Control Hosp Epidemiol 2012

Par rapport à non décolonisation
stratégie traitement tous patients
Et stratégie dépister et traiter
porteurs coût efficaces

FIGURE 1. Simple decision model for patients undergoing total joint arthroplasty (TJA) to have no treatment, be treated preoperatively with mupirocin, or be screened and then, if *Staphylococcus aureus* carriage is detected, treated with mupirocin. SSI, surgical site infection.

Reduced Costs for *Staphylococcus aureus* Carriers Treated Prophylactically with Mupirocin and Chlorhexidine in Cardiothoracic and Orthopaedic Surgery

Miranda M. L. van Rijen^{1*}, Lonneke G. M. Bode^{2,3}, Diane A. Baak³, Jan A. J. W. Kluytmans^{1,4}, Margreet C. Vos²

Cost Reduction by Mupirocin Prophylaxis

Plos 2012

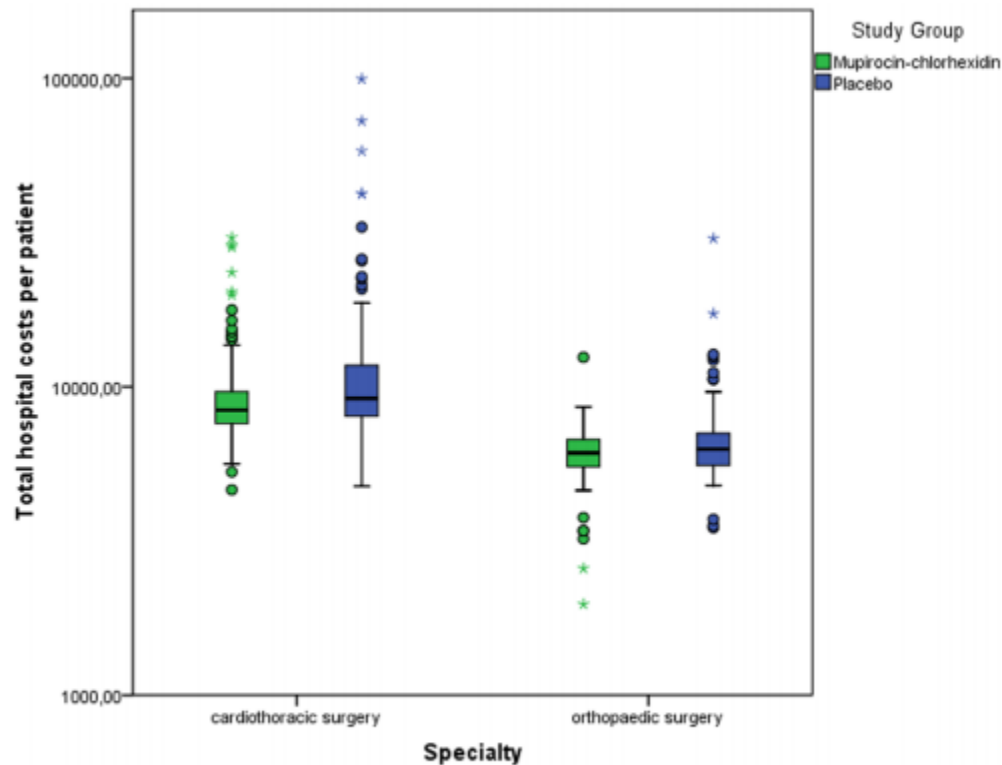


Figure 2. Box plot of total hospital costs for patients treated prophylactically with MUP-CHX or placebo. Total costs were estimated for the period between the dates of admission and the end of follow-up. Data are shown for cardiothoracic patients and orthopaedic surgical patients, separately. Patients with highest costs are shown in bullets ● (between 1,5 and 3 times the interquartile range) and asterisks * (more than 3 times the interquartile range).
doi:10.1371/journal.pone.0043065.g002

Mupirocine => 2841 euros de moins en chirurgie cardiaque, et 955 euros de moins en chirurgie orthopédique / placebo

Quel produits pour décoloniser les patients ?

- Mupirocine = traitement de référence *Simor Lancet Infect Dis 2012*
- Essai randomisé en ouvert PVPI vs mupirocine (associée à décolonisation cutanée chlorhexidine) 5 jours avant chirurgie orthopédique avec suivi ISO à 3 mois 1700 interventions : non-infériorité PVPI. *Phillips Infect Control Hosp Epidemiol 2014*
- Autres : cf table mais efficacité à prouver *Landelle J Antimicrob Chemother 2016*

Panel: Agents and approaches for *Staphylococcus aureus* decolonisation

Topical agents

Bacitracin
Chlorhexidine
Chlortetracycline
Fusidic acid
Gentamicin
Hexachlorophene
Lysostaphin
Medicinal honey
Mersacidin
Mupirocin
Neomycin
Octenidine
Povidone-iodine
Polymyxin B
Retapamulin
Sulfonamides
Tea tree oil (*Melaleuca alternifolia*)
Triclosan
Vancomycin

Systemic agents

Ciprofloxacin
Cloxacillin
Doxycycline
Fusidic acid
Minocycline
Novobiocin
Rifampicin
Sulfathiazole
Vancomycin
Co-trimoxazole

Other strategies

Bacterial interference (*S aureus* 502a)
Photodynamic therapy
S aureus phage therapy
S aureus vaccine

*Simor
Lancet Infect Dis
2012*

La décolonisation en chirurgie orthopédique ça marche

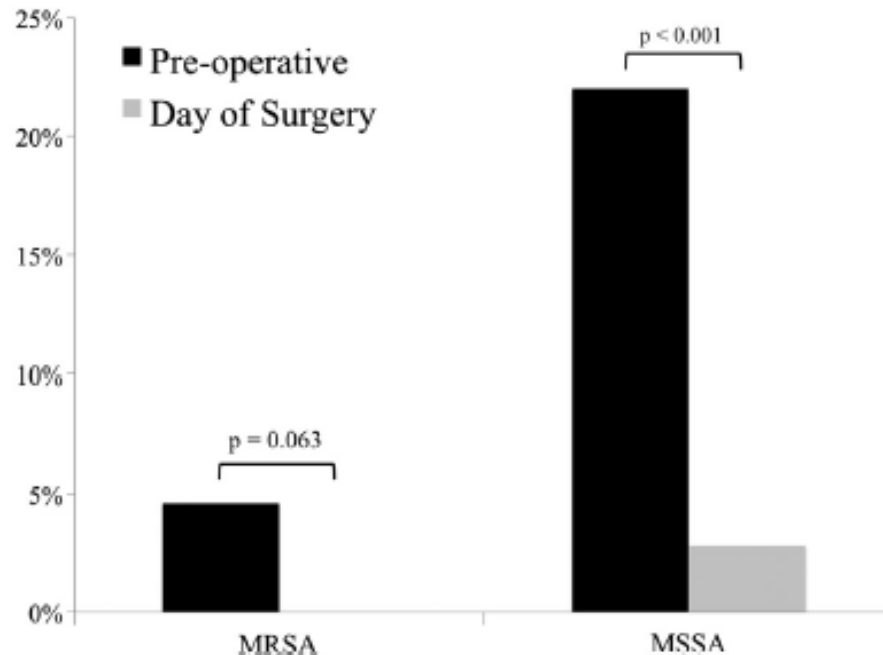


Fig. 2. Incidence of methicillin-sensitive *Staphylococcus aureus* (MSSA) and methicillin-resistant *Staphylococcus aureus* (MRSA) colonization prior to surgery (Pre-operative) and on the day of surgery. There was no MRSA colonization on the day of surgery, and there was significantly reduced MSSA colonization on the day of surgery.

106 patients US, première chirurgie prothétique, prélèvement nasal 1 à 6 semaines avant la chirurgie et jour de la chirurgie, observance patient 97% : mupirocine intranasal et douches chlorhexidine

Chen J Arthroplasty 2013

Observance des patients ?

Surgical Site Infection Prevention Initiative

Patient Attitude and Compliance

Nicholas Ramos, B.A., Faith Skeete, R.N., Janet P. Haas, DNSc, R.N., Lorraine Hutzler, B.A., James Slover, M.D., M.S., Michael Phillips, M.D., and Joseph Bosco, M.D.

Abstract

Background. Although the effect of *Staphylococcus aureus* (SA) decolonization on surgical site infection (SSI) rates has been studied, patient tolerance and acceptance of these regimens has not been assessed. Surgical patients at our hospital's Pre-Admission Testing Clinic (PAT) receive SA reduction protocols instructing the preoperative use of chlorhexidine gluconate (CHG) soap and intranasal mupirocin ointment (MO). Certain insurers do not cover MO costs resulting in out of pocket (OOP) expenses for some patients.

Objective. This study assessed patient attitudes and compliance with our hospital's SA decolonization regimen.

Methods. One-hundred-forty-six patients received surveys. Descriptive statistics were used for analysis.

Results. Of respondents fitting inclusion criteria, 81% followed the MO protocol (MO users) while 89% followed the CHG protocol (CHG users). Fifty-four percent of MO users reported OOP expenses and 13% reported a hard or very hard financial burden. Ninety-three percent of CHG users reported the protocol was easy or very easy to follow.

Conclusion. Eighty-one percent of patients receiving the SA protocol were fully compliant despite cost or difficulty obtaining MO. Given these barriers and some difficulty with CHG application, we hypothesize compliance may be improved if MO is provided to patients without OOP expenses and if the CHG application method is simplified.

*Bulletin of the NYU Hospital
for Joint Diseases 2011*

Décolonisation universelle ou ciblée ?

Clinical Infectious Diseases

INVITED ARTICLE

HEALTHCARE EPIDEMIOLOGY: Robert A. Weinstein, Section Editor



Clinical Infectious Diseases

EDITORIAL COMMENTARY



Prevention of Surgical Site Infections: Decontamination With Mupirocin Based on Preoperative Screening for *Staphylococcus aureus* Carriers or Universal Decontamination?

David J. Hetem,¹ Martin C. J. Bootsma,^{2,3} and Marc J. M. Bonten^{1,2}

Considering Universal Mupirocin Decolonization as an Option for Preventing Surgical Site Infections

David P. Calfee

Department of Medicine, Weill Cornell Medicine, New York, New York

Table 1. Characteristics of Targeted and Universal Perioperative Decolonization Strategies

Characteristic	Universal Decolonization	Targeted Screening and Decolonization
Implementation of strategy	Easy prescription of medication	Logistics can and will be challenging for screening, reporting of results, and prescription of medication
Sensitivity of strategy	100% (<i>Staphylococcus aureus</i> carriers will not be missed)	Suboptimal (some patients may not be screened, test procedure may not have 100% sensitivity, and nonnasal <i>S. aureus</i> carriers may be missed)
Volume of mupirocin use	Approximately 5 times that in targeted strategy	Detected <i>S. aureus</i> carriers only
Volume of screening	Absent	All subjects
Cost components	Allocation of medication, mupirocin	Screening, reporting, allocation of medication, and mupirocin

Faisabilité plaide pour décolonisation universelle

Plus efficiente

MAIS

Augmentation résistance :

- Mupirocine *Lee J Hosp Infect* 2011
- Chlorhexidine *Sekiguchi Jpn J Infect Dis* 2004

Au total, aux USA seulement 40 à 60 % des Établissements ont mis en place stratégie de décolonisation. *Kline Infect Control Hosp Epidemiol* 2014

Comment démontrer l'intérêt de la décolonisation des porteurs de *S. aureus* avant chirurgie orthopédique prothétique ?

- Tendence statistique à diminution risque ISO à *S. aureus* si décolonisation. *Verhoeven Clin Orthop Relat Resp 2013, Chen Clin Ortop Relat Resp 2013*
- Nombre de 7000 à 14 000 patients nécessaire pour montrer une diminution de 20% du risque d'ISO après décolonisation par mupirocine si taux de base est de 5% ! *Courville Infect Control Hosp Epidemiol 2012*
- Soumission PHRC 2014 Dr E. Botelho-Nevers : Impact de la décolonisation du portage de *Staphylococcus aureus* en chirurgie orthopédique prothétique sur la survenue d'infections du site opératoire: étude prospective randomisée, contrôlée versus placebo, en double aveugle. Lettre intention refusée : groupe contrôle ?
- Nouvelle soumission 2015 PHRC ? => faisabilité impossible car de nombreux centres pressentis avaient commencé à appliquer décolonisation des patients

Alors comment répondre à la question de la décolonisation avant chirurgie orthopédique prothétique ?

Research

Original Investigation | ASSOCIATION OF VA SURGEONS

Effect of a Preoperative Decontamination Protocol on Surgical Site Infections in Patients Undergoing Elective Orthopedic Surgery With Hardware Implantation

Serge P. Bebko, MD; David M. Green, MD; Samir S. Awad, MD, MPH

JAMA 2015

Etude avant / après, sans groupe contrôle
Triple décolonisation : nasale (PVPI),
oro-pharyngée (Chlorhexidine), et cutanée
(Chlorhexidine) soir et matin avant chirurgie
Suivi ISO à 30 jours : 732 patients

Table 4. Multivariate Analysis of Independent Risk Factors Associated With the Development of SSIs^a

Risk Factor	Adjusted OR (95% CI)	P Value
Decontamination	0.24 (0.08-0.77)	.02
Duration of surgery ≥150 min	4.59 (1.67-12.65)	.003
COPD	6.76 (2.16-21.19)	.001

Abbreviations: COPD, chronic obstructive pulmonary disease; OR, odds ratio; SSIs, surgical site infections.

^a Only risk factors found to be statistically significant on multivariate analysis are shown.

Alors comment répondre à la question de la décolonisation avant chirurgie orthopédique prothétique ?

Original Investigation

Association of a Bundled Intervention With Surgical Site Infections Among Patients Undergoing Cardiac, Hip, or Knee Surgery

Marin L. Schweizer, PhD; Hsiu-Yin Chiang, MS, PhD; Edward Septimus, MD; Julia Moody, MS; Barbara Braun, PhD; Joanne Hafner, RN, MS; Melissa A. Ward, MS; Jason Hickok, MBA, RN; Eli N. Perencevich, MD, MS; Daniel J. Diekema, MD; Cheryl L. Richards, MJ, LPN, LMT; Joseph E. Cavanaugh, PhD; Jonathan B. Perlin, MD, PhD; Loreen A. Herwaldt, MD

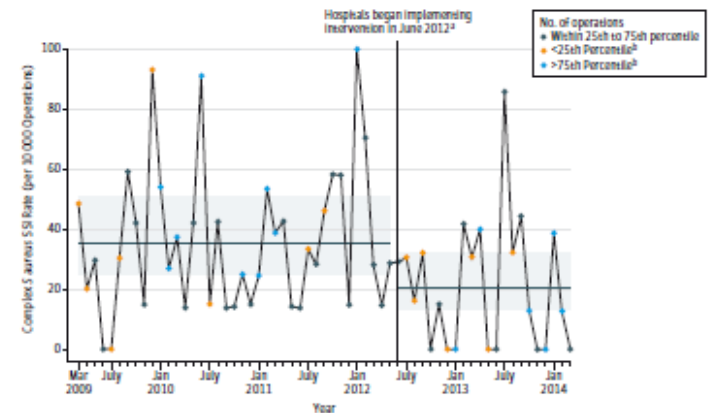
JAMA 2015

« essai pragmatique » STOP-SSI,
étude avant / après sans groupe contrôle,
20 hopitaux, 60 mois de
suivi ISO chirurgie cardiaque et orthopédique.
42 000 patients

Screening nasal, si positif *S. aureus*
Décolonisation nez et peau 5 jours
avant chirurgie, si SARM Antibioprophylaxie
vanco + C2G, SAMS C2G

Plus observance élevée bundle plus baisse
ISO (SS)

Figure 1. Pooled Rate of Complex *Staphylococcus aureus* Surgical Site Infections (SSIs) by Admission Month



The spike in the rate of complex *S aureus* SSI rate in July 2013 occurred among patients whose surgeons did not implement the bundle. The complex *S aureus* SSI rate was 50 per 10 000 operations in the subgroup of operations done by surgeons implementing the bundle and was 24.0 per 10 000 operations in the subgroup of operations done by surgeons not implementing the bundle.

^a The number of months without any complex *S aureus* SSIs increased from 2 of 39 (5.1%) to 8 of 22 (36.4%; $P = .006$ by the Fisher exact test). Poisson regression analysis found a significant decrease in complex *S aureus* SSIs from 36/10 000 operations (95% CI, 25–51) during preintervention period to 21 per

10 000 operations (95% CI, 13–32) during intervention period (rate ratio, 0.58 [95% CI, 0.37–0.92]); the shaded areas indicate the 95% CIs of the Poisson regression analysis. Hospitals implemented the bundle on a rolling basis (earliest, June 1, 2012; latest, October 9, 2012). Eleven hospitals (55%) implemented the bundle by July 1, 2012.

^b See eTable 3 in Supplement 2 for the monthly number of complex *S aureus* SSIs, number of operations, and rate of complex *S aureus* SSIs for each hospital.

Table 2. Poisson Regression Analysis of Monthly Rates of Complex *Staphylococcus aureus* Surgical Site Infections per 10 000 Operations

	Preintervention Period		Intervention Period		Rate Ratio for Bundled Intervention (95% CI)	P Value
	No. of Operations	Mean Rate (95% CI)	No. of Operations	Mean Rate (95% CI)		
All operations	28 218	36 (25–51)	14 316	21 (13–32)	0.58 (0.37–0.92) ^a	.02
Urgent/emergent			1189	37 (15–88)	1.03 (0.41–2.57) ^a	.95
Scheduled			13 127	20 (13–30)	0.55 (0.35–0.86) ^a	.009
Cardiac operations	7576	46 (26–82)	3257	40 (23–70)	0.86 (0.47–1.57) ^b	.63
Urgent/emergent			571	67 (32–137)	1.44 (0.53–3.91) ^b	.48
Scheduled			2686	33 (18–62)	0.72 (0.45–1.15) ^b	.17
Hip or knee arthroplasties	20 642	32 (21–48)	11 059	15 (10–24)	0.48 (0.29–0.80) ^c	.005
Urgent/emergent			618	14 (3–75)	0.44 (0.07–2.72) ^c	.38
Scheduled			10 441	16 (10–26)	0.51 (0.30–0.85) ^c	.009

Abbreviations: SSI, surgical site infection.

^a Compared with the monthly rates of complex *S aureus* SSIs after all operations performed during the preintervention period.

^b Compared with the monthly rates of complex *S aureus* SSIs after all cardiac operations performed during the preintervention period.

^c Compared with the monthly rates of complex *S aureus* SSIs after all hip or knee arthroplasties performed during preintervention period.

Efficacité à long terme de la décolonisation chez des patients d'orthopédie ?

Persistence of *Staphylococcus aureus* Decolonization • Immerman et al 873

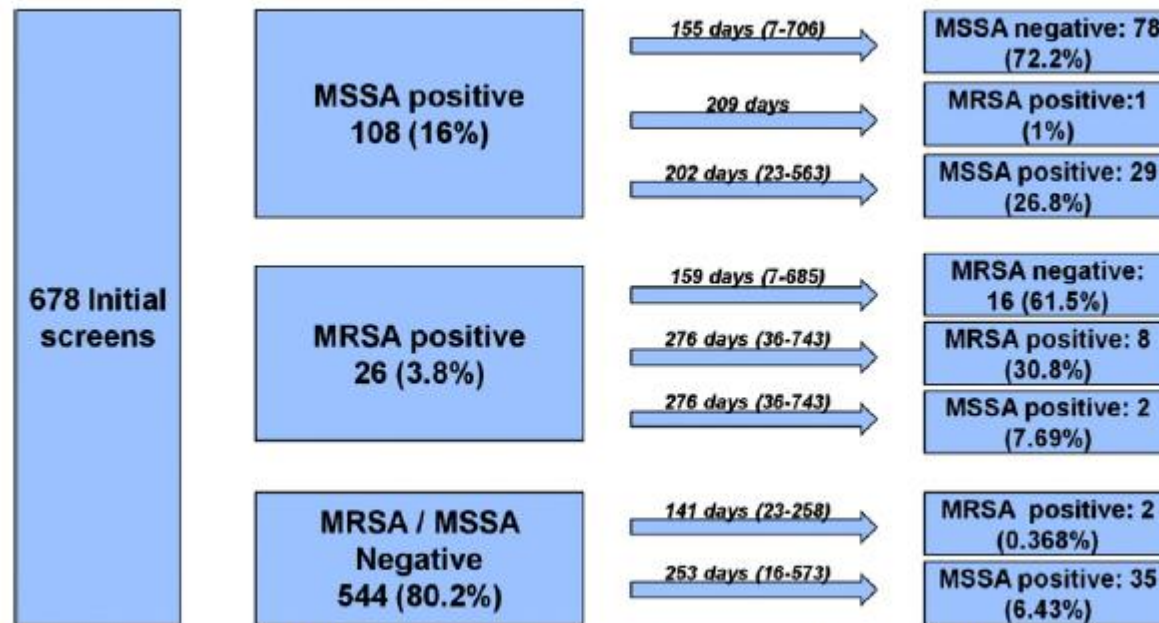


Fig. 3. Flowchart demonstrating the breakdown of initial and repeat culture results. Mean, minimum, and maximum number of elapsed days between cultures are shown as well.

5 jours mupirocine intra nasal et 1 douche pré-opératoire avec chlorhexidine (94 % observance décolonisation) => 70 % décolonisation

Intérêt de dépister à nouveau et de re décoloniser patient si nouvelle procédure

Immerman J Arthroplasty 2012

Mortalité et décolonisation ?

ORIGINAL ARTICLE

Long-term Mortality After Rapid Screening and Decolonization of *Staphylococcus Aureus* Carriers

Observational Follow-up Study of a Randomized, Placebo-controlled Trial

Lonneke G. M. Bode, MD, PhD,* Miranda M. L. van Rijen, MSc, PhD,† Heiman F. L. Wertheim, MD, PhD,*
Christina M. J. E. Vandenbroucke-Grauls, MD, PhD,‡ Annet Troelstra, MD, PhD,§ Andreas Voss, MD, PhD,¶
Henri A. Verbrugh, MD, PhD,* Margreet C. Vos, MD, PhD,* and Jan A. J. W. Kluytmans, MD, PhD†‡

Annals of Surgery • Volume 263, Number 3, March 2016

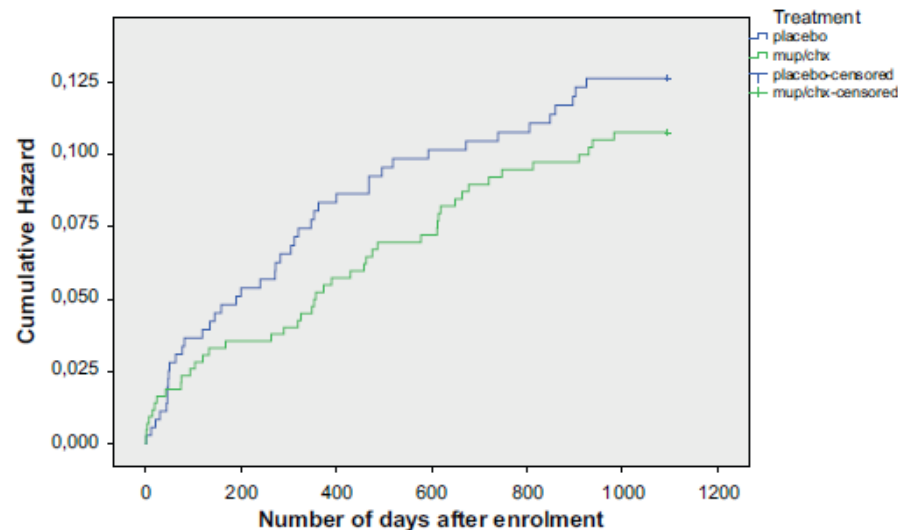


FIGURE 1. Kaplan-Meier curves showing cumulative hazard of mortality in the 2 treatment groups.

To Prevent Surgical Site Infections (SSIs):

Before surgery

- Administer antimicrobial prophylaxis in accordance with evidence-based standards and guidelines
- Treat remote infections-whenver possible before elective operations
- Avoid hair removal at the operative site unless it will interfere with the operation; do not use razors
- Use appropriate antiseptic agent and technique for skin preparation

During Surgery

- Keep OR doors closed during surgery except as needed for passage of equipment, personnel, and the patient

After Surgery

- Maintain immediate postoperative normothermia
- Protect primary closure incisions with sterile dressing
- Control blood glucose level during the immediate post-operative period (cardiac)
- Discontinue antibiotics according to evidence-based standards and guidelines

Also consider

Before surgery:

- Nasal screening and decolonization for *Staphylococcus aureus* carriers for select procedures (i.e., cardiac, orthopaedic, neurosurgery procedures with implants).
- Screen preoperative blood glucose levels and maintain tight glucose control

During surgery:

- Redose antibiotic at the 3 hr interval in procedures with duration >3hrs
- Adjust antimicrobial prophylaxis dose for obese patients (body mass index >30)
- Use at least 50% fraction of inspired oxygen intraoperatively and immediately postoperatively in select procedure(s)

Conclusion

- Bien appliquer les recommandations en hygiène ayant fait leurs preuves dont surveillance des ISO. *Kalmeijer Clin Infect Dis 2002, Anderson Infect Control hosp Epidemiol 2014*
- Arguments scientifiques pour utilité décolonisation nasale *S. aureus* chez les porteurs avant chirurgie orthopédique prothétique
- Questions non résolues :
 - décolonisation universelle vs ciblée : efficacité vs émergence de résistances.
 - Pour quelles chirurgies orthopédiques ? Pour quels patients ?
 - Quel(s) produits pour décoloniser ?
 - Timing de la décolonisation ?