Décolonisation du portage de *Staphylococcus aureus* avant chirurgie orthopédique

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Inserm CIC 1408- Axe Vaccinologie, I-Reivac, Covireivac

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Liens d'Intérêt en lien avec ce cours

- Investigateur associé/ principal essai vaccins académiques et industriels CIC 1408 Axe vaccinologie-I-REIVAC: Sanofi Pasteur; GSK, MSD, Pfizer….
- Advisory Board Vaccin *S. aureus* (Pfizer)
- Collaboration étude préclinique (Sanofi -Pasteur)
- Investigateur principal d'un PHRC CIBERSTAPH: décolonisation ciblée des porteurs persistants en hémodialyse

- Conflit d'intêret: AUCUN

De quoi parle t-on?

- *S. aureus* est le 1er agent responsable d'infections du site opératoire (ISO)
- Les infections sont endogènes dans > 80% des cas: souche du patient
- Les porteurs dits 'persistants' (portage prolongé, charge bactérienne élevée) sont ceux qui sont à haut risque d'infection

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journal homepage: www.ajicjournal.org

Brief report

Are the risk factors associated with *Staphylococcus aureus* nasal carriage in patients the same than in healthy volunteers? Data from a cohort of patients scheduled for orthopedic material implantation

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Dans la « vraie vie », les facteurs de risque de portage sont différents de ceux chez les volontaires sains: obésité et sujets plus jeunes sont les plus à risque de portage

Tong et al., CMR 2015
Surveillance des infections du site opératoire dans les établissements de santé français. Résultats 2016
Kalmeijer *et al.,* Infect Control Hosp Epidemiol. 2000;21:319-23
Verhoeven PO, et al., Expert Rev Anti Infect Ther. 2014 Jan;12(1):75-89.
Verhoeven PO, et al., Medicine (Baltimore). 2016 Apr;95(14):e3231

De quoi parle t-on?

- La colonisation à *S. aureus* est associée à un sur-risque d'infections à cette bactérie, notamment en chirurgie:

  - Chirurgie orthopédique: X 3 à 16
  - Chirurgie cardio-thoracique: x 3 à 9
  - Chirurgie vasculaire: X10
  - Dialyse péritonéale: X3 à 10
  - Hémodialyse: x 1,8 à 4,7
  - Patients de réanimation: X 4 à 14
  - Patients HIV+: X 3 à 5
  - Infections cutanées à répétitions

  ⋮

Kalmeijer *et al.,* ICHE 2000
Berthelot *et al.,* EJCMID 2010
Kluytmans *et al.,* J Infect Dis 1995
Munoz *et al*., J Hosp Infect 2008
Donker JMW, PLoS ONE 2012
Nouwen et al., Kidney International 2005
Verhoeven et al., Medicine 2016
Allen *et al*.,Open Forum Infect Dis. 2014
Paling et al., CMI 2016
Wertheim et al., LID 2005
Hedstrom SA *Scand J Infect Dis* 1981
Durupt F *et al.*, Br J Dermatol 2007

Focus sur l'orthopédie

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

N= 272

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
Staphylococcus aureus nasal carriage (any)	2.3	0.8-6.4
S aureus nasal carriage (high level)	3.1	1.1-9.0
S aureus 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
Staphylococcus aureus nasal carriage (any)	8.9	1.7-45. 5
S aureus nasal carriage (high level)	16.0	3.1-82.2

Abbreviations: CI_{95}, 95% confidence interval; RR, relative risk.

En analyse multivariée:

- Any SSI:
  - *S. aureus* nasal carriage (high level) p= 0.04
  - Male gender p=0.005
  - Surgeon 1 p=0.006
- S. aureus SSI:
  - *S. aureus* nasal carriage (high level) p= 0.002

Kalmeijer *et al.,* Infect Control Hosp Epidemiol. 2000;21:319-23

N= 3908

Risks factors	Univariate analysis	Multivariate analysis	
	p-value	*p*-value	Exp (B) 95% CI
For SSI overall			
Centre	<0.01	0.0379	Adjustment factor
Age	0.03		
BMI	<0.001		
Tobacco use	0.003	0.0018	2.244 [1.352–3.726]
Diabetes	0.04		
Cancer	0.06		
Corticosteroids	0.1		
First implantation	0.07		
Duration of surgery	0.004		
Haematoma	0.002	0.0026	4.665 [1.714–12.695]
Nasal carriage of *S. aureus*	0.3		
NNIS	<0.001	<0.0001	3.073 [1.874–5.038]
ASA score >2	<0.01		
For SSI due to *S. aureus*			
Centre	NS	0.9978	Adjustment factor
ASA score >2	<0.01		
BMI	0.2		
Tobacco use	0.005	0.0024	3.907 [1.621–9.420]
Diabetes	0.025		
Cancer	0.02		
Duration of surgery	0.02		
Nasal carriage of *S. aureus*	0.02	0.0208	2.786 [1.169–6.640]
NNIS	<0.001	0.0007	5.205 [2.013–13.455]

Berthelot *et al.,* Eur J Clin Microbiol Infect Dis. **2010** ;29:373-82

Agir sur ce portage devrait permettre de réduire les infections du site opératoire à *S. aureus*

Que montrent les études?

N Engl J Med 2002;346:1871-7

INTRANASAL MUPIROCIN TO PREVENT POSTOPERATIVE *STAPHYLOCOCCUS AUREUS* INFECTIONS

TRISH M. PERL, M.D., JOSEPH J. CULLEN, M.D., RICHARD P. WENZEL, M.D., M. BRIDGET ZIMMERMAN, PH.D., MICHAEL A. PFALLER, M.D., DEBORAH SHEPPARD, JENNIFER TWOMBLEY, R.N., PAMELA P. FRENCH, M.D., M.P.H., LOREEN A. HERWALDT, M.D., AND THE MUPIROCIN AND THE RISK OF *STAPHYLOCOCCUS AUREUS* STUDY TEAM*

TABLE 4. OVERALL AND *STAPHYLOCOCCUS AUREUS*–SPECIFIC RATES OF NOSOCOMIAL INFECTION AMONG PATIENTS WHO RECEIVED MUPIROCIN AND THOSE WHO RECEIVED PLACEBO.

TYPE OF INFECTION	MUPIROCIN RECIPIENTS			PLACEBO RECIPIENTS		
	TOTAL (N=1933)	*S. AUREUS* CARRIERS (N=444)	NONCARRIERS (N=1489)	TOTAL (N=1931)	*S. AUREUS* CARRIERS (N=447)	NONCARRIERS (N=1484)
	number/total number (percent)					
Nosocomial infection*	218/1933 (11.3)	57/444 (12.8)	161/1489 (10.8)	220/1931 (11.4)	72/447 (16.1)	148/1484 (10.0)
Nosocomial *S. aureus* infection*	45/1884 (2.4)	17/430 (4.0)	28/1454 (1.9)	55/1886 (2.9)	34/439 (7.7)†	21/1447 (1.5)
Surgical-site infection	152/1933 (7.9)	44/444 (9.9)	108/1489 (7.3)	164/1931 (8.5)	52/447 (11.6)	112/1484 (7.5)
S. aureus surgical-site infections‡	43/1892 (2.3)	16/432 (3.7)	27/1460 (1.8)	46/1894 (2.4)	26/439 (5.9)	20/1455 (1.4)

*This group includes *S. aureus* infections of the bloodstream, respiratory tract, catheter, and surgical site.

†P=0.02 for the comparison with the *S. aureus* carriers in the mupirocin group (odds ratio, 0.49; 95 percent confidence interval, 0.25 to 0.92).

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JANUARY 7, 2010 VOL. 362 NO. 1

Preventing Surgical-Site Infections in Nasal Carriers of *Staphylococcus aureus*

Lonneke G.M. Bode, M.D., Jan A.J.W. Kluytmans, M.D., Ph.D., H
Diana Bogaers, I.C.P., Christina M.J.E. Vandenbroucke-Grauls, M.
Annet Troelstra, M.D., Ph.D., Adrienne T.A. Box, B.A.Sc., Andreas Voss,
Alex van Belkum, Ph.D., Henri A. Verbrugh, M.D., Ph.D., an

RANDOMIZATION

Patients were randomly assigned in a 1:1 ratio to either active treatment with mupirocin ointment 2% (Bactroban, GlaxoSmithKline) in combination with chlorhexidine gluconate soap, 40 mg per milliliter (Hibiscrub, Mölnlycke), or placebo ointment in combination with placebo soap. Placebo soap

	Mupirocin and Chlorhexidine		Placebo		RR (95% CI)
All surgical patients (n=808) (No. of *S. aureus* infections / No. of patients)	16/441	(3.6%)	31/367	(8.4%)	0.41 (0.22-0.76)
Cardiothoracic surgery (n=391)	3/220	(1.4%)	15/171	(8.8%)	0.14 (0.04-0.51)
Gastrointestinal surgery (n=43)†	2/22	(9.1%)	3/21	(14.3%)	0.60 (0.09-4.01)
General surgery (n=107)‡	3/61	(4.9%)	3/46	(6.5%)	0.74 (0.14-3.85)
Orthopedics (n=172)	1/85	(1.2%)	4/87	(4.6%)	0.25 (0.03-2.26)
Vascular surgery (n=95)*	7/53	(13.2%)	6/42	(14.3%)	0.91 (0.28-2.96)

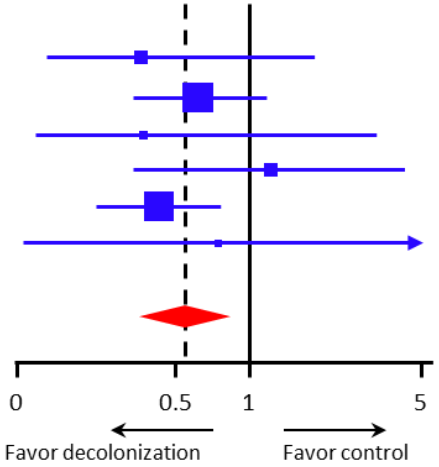
Bénéfice de la décolonisation en chirurgie orthopédique?

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

Paul O. Verhoeven MD, MS, Philipe 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

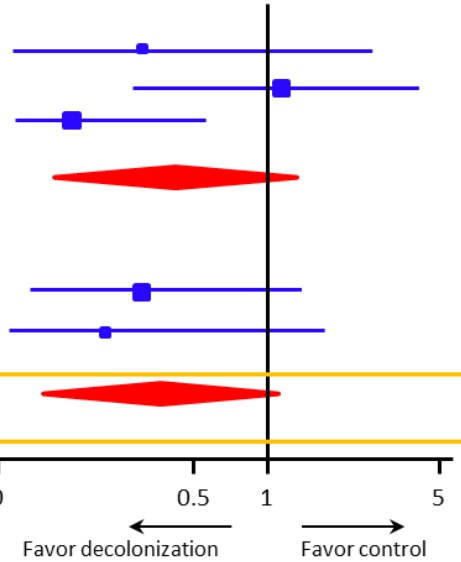
Clin Orthop Relat Res (2013) 471:3709–3711

	Decolonization strategy		Control			
	No. events	No. patients	No. events	No. patients	RR	[95%-CI]
Kalmeijer, 2002	2	95	5	86	0.37	[0.07; 1.82]
Perl, 2002	16	432	26	439	0.63	[0.34; 1.15]
Garcia, 2003	1	31	3	34	0.37	[0.04; 3.33]
Konvalinka, 2006	5	130	4	127	1.22	[0.34; 4.44]
Bode, 2010	16	441	31	367	0.43	[0.24; 0.77]
Shuman, 2012	0	15	0	11	0.74	[0.02; 34.7]
Overall (fixed effect model) p Heterogeneity = 0.74	40	1144	69	1064	**0.54**	**[0.37; 0.79]**



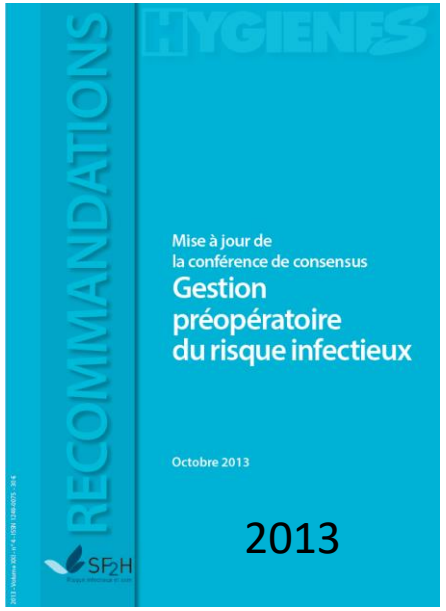
B

(i)						
Garcia, 2003	1	31	3	34	0.37	[0.04; 3.33]
Konvalinka, 2006	5	130	4	127	1.22	[0.34; 4.44]
Bode, 2010	3	220	15	171	0.16	[0.05; 0.53]
Cardio-thoracic surgery (random effect model)	9	381	22	332	**0.41**	**[0.10; 1.67]**
(ii)						
Kalmeijer, 2002	2	95	5	86	0.37	[0.07; 1.82]
Bode, 2010	1	85	4	87	0.26	[0.03; 2.24]
Orthopedic surgery (fixed effect model)	3	180	9	173	**0.32**	**[0.09; 1.17]**



Nécessite une étude randomisée contre placebo:
>15000 patients, 4500 porteurs

Que disent les recommandations?



2013

R1 Il est recommandé de réaliser une décolonisation du portage de *Staphylococcus aureus* chez les patients bénéficiant d'une chirurgie cardiaque pour réduire le taux d'infection du site opératoire à *S. aureus*. (A2)

R2 Aucune recommandation ne peut être émise sur le bénéfice de la décolonisation du portage de *Staphylococcus aureus* sur le taux d'infection du site opératoire à *S. aureus* chez les patients bénéficiant d'une chirurgie orthopédique prothétique programmée. (C3)

R5 Aucune recommandation ne peut être émise sur la nécessité d'un dépistage nasal de *Staphylococcus aureus* préalable avant la mise en route d'une stratégie de décolonisation, pour la réduction des infections du site opératoire à *S. aureus*. (C3)

R9 Il est recommandé d'associer à la décolonisation nasale péri-opératoire de *Staphylococcus aureus* par mupirocine, une décolonisation corporelle et oropharyngée par un produit antiseptique efficace contre *S. aureus*. (B3)

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

JAMA 2015. 313(21):2162-71

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

Dépistage portage MSSA/MRSA
Décolonisation si portage
ATB prophylaxie adaptée

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. Ope			
All operations	28		0.58 (0.37-0.92)[a]	.02
Urgent/emergent			1.03 (0.41-2.57)[a]	.95
Scheduled			0.55 (0.35-0.86)[a]	.009
Cardiac operations	75		0.86 (0.47-1.57)[b]	.63
Urgent/emergent			1.44 (0.53-3.91)[b]	.48
Scheduled			0.72 (0.45-1.15)[b]	.17
Hip or knee arthroplasties	20		0.48 (0.29-0.80)[c]	.005
Urgent/emergent			0.44 (0.07-2.72)[c]	.38
Scheduled			0.51 (0.30-0.85)[c]	.009

Malgré un gros effectif cela reste une étude avant/après non randomisée, non contrôlée

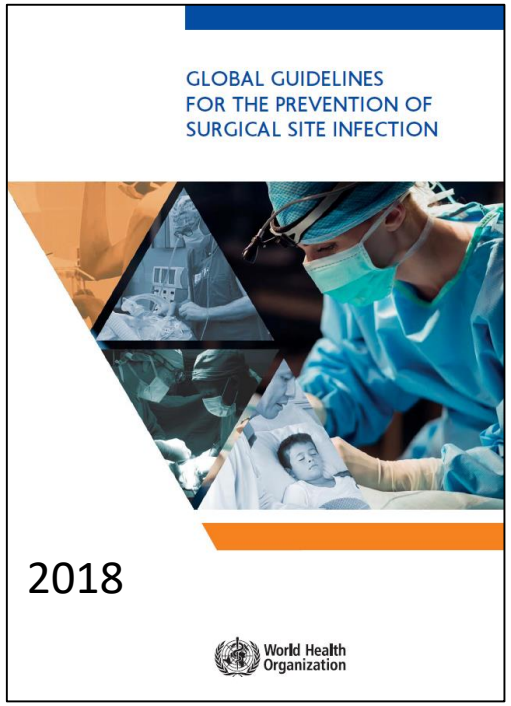
Abbreviations: SSI, surgical site infection.

[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.

Year



4.2 Decolonization with mupirocin ointment with or without chlorhexidine gluconate body wash for the prevention of *Staphylococcus aureus* infection in nasal carriers undergoing surgery

Recommendations

1. The panel recommends that patients undergoing cardiothoracic and orthopaedic surgery with known nasal carriage of *S. aureus* should receive perioperative intranasal applications of mupirocin 2% ointment with or without a combination of CHG body wash.
   (Strong recommendation, moderate quality of evidence)

2. The panel suggests considering to treat also patients with known nasal carriage of *S. aureus* undergoing other types of surgery with perioperative intranasal applications of mupirocin 2% ointment with or without a combination of CHG body wash.
   (Conditional recommendation, moderate quality of evidence)

Nouvelles données?

The Journal of Arthroplasty 36 (2021) 752–766

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Systematic Review and Meta-Analysis

Is Preoperative *Staphylococcus aureus* Screening and Decolonization Effective at Reducing Surgical Site Infection in Patients Undergoing Orthopedic Surgery? A Systematic Review and Meta-Analysis With a Special Focus on Elective Total Joint Arthroplasty

Ana I. Ribau, MD [a,*], Jamie E. Collins, PhD [b], Antonia F. Chen, MD, MBA [b], Ricardo J. Sousa, MD, PhD [a,c]

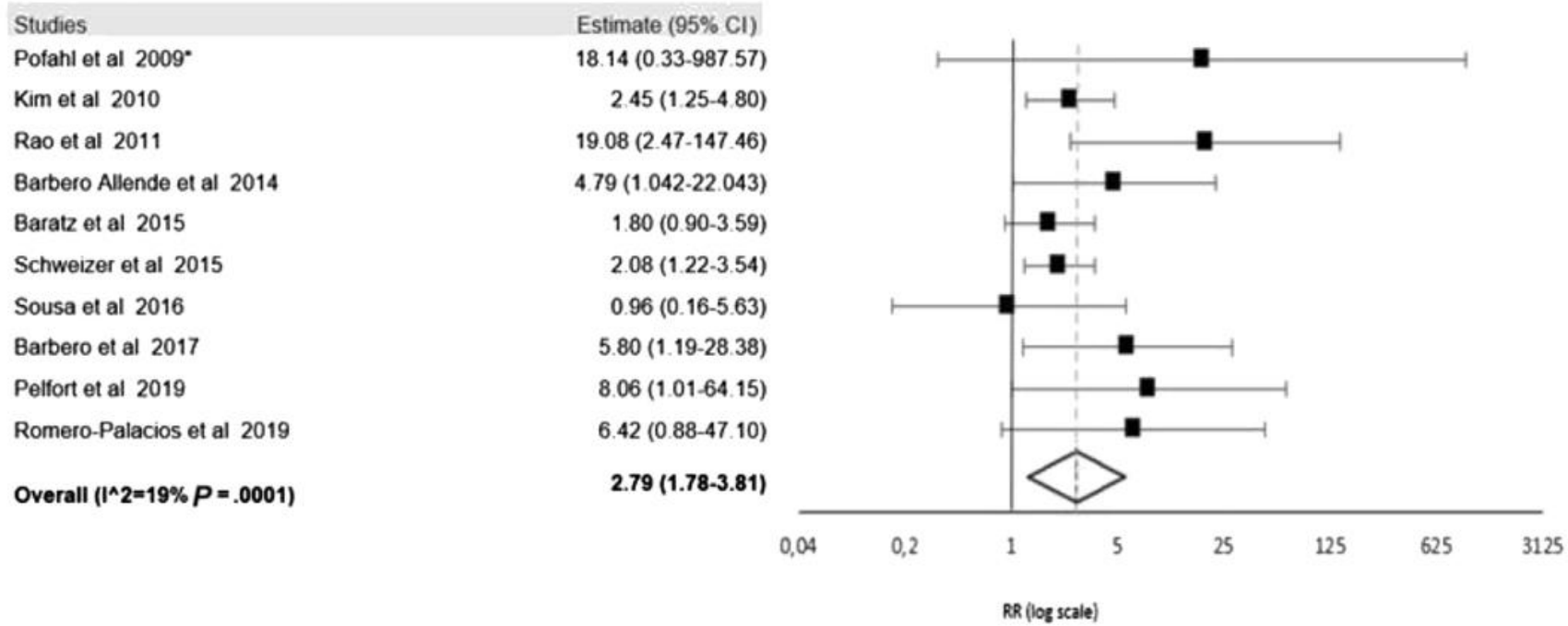


Fig. 6. Forest plots showing the RR of *S aureus* infection control vs nasal and skin decolonization for all orthopedic procedures (*approximate RRs—study with zero cells, applying a continuity correction of 0.25).

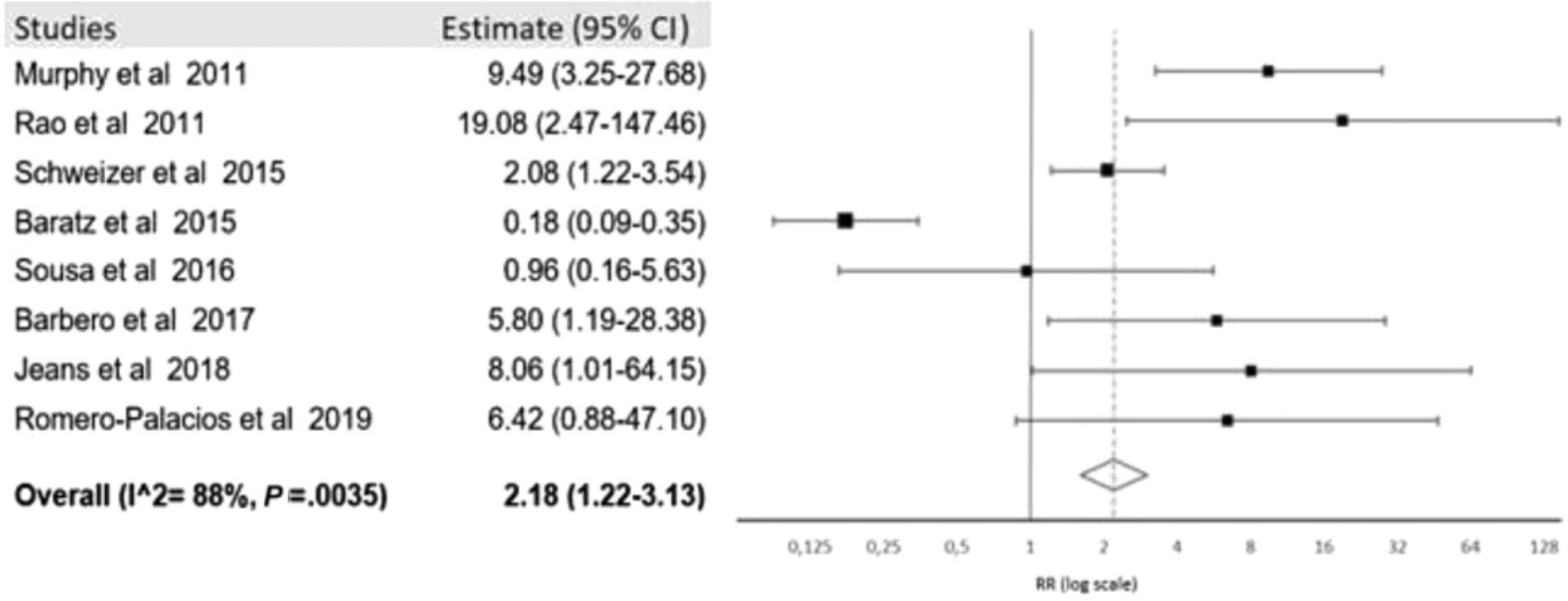


Fig. 8. Forest plots showing the RR of *S aureus* infection control vs nasal and skin decolonization in total joint arthroplasty.

Nasal colonization of *S aureus* at the time of surgery is a risk factor for SSI/PJI in orthopedic and elective TJA surgery. This systematic review and meta-analysis determined that the implementation of a traditional *S aureus* screening and whole-body decolonization protocol using mupirocin and chlorhexidine can reduce infection after TJA. However, this finding is mostly based upon retrospective studies, so larger-scale prospective multicenter studies are needed to further scrutinize its real value. The actual

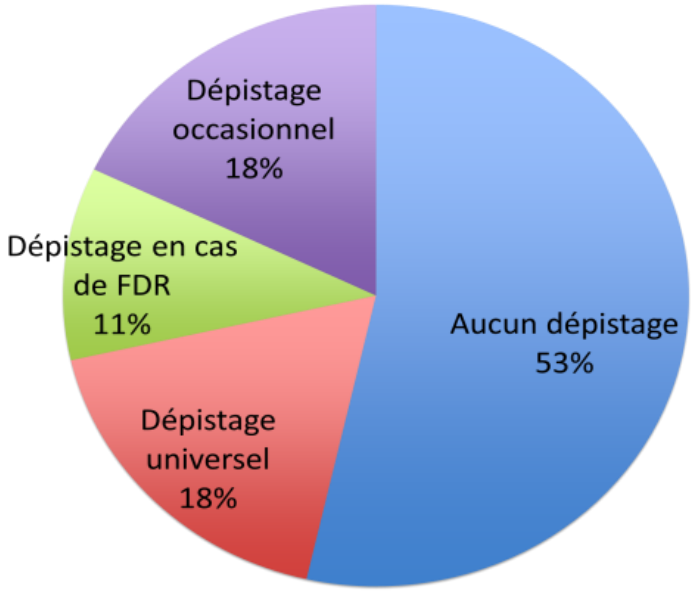
Faute d’étude de qualité et de recommandations nationales que fait-on?

En pratique dans les centres…..ce qui est fait

- Etude auprès du CRIOAC de Lyon et de la SFHG 1er Trimestre 2017:

	N = 147 (%)
Liste de diffusion	
SFGH	62 (42,2)
CRIOAc	85 (57,8)
Spécialités	
Orthopédistes	117 (80)
Infectiologues	22 (15)
Autres	8 (5) dont 2 anesthésistes
Région d'exercice	
AURA	95 (64)
PACA	10 (7)
Ile de France	15 (10)
Centre Val-de-Loire	10 (7)
Grand-Est	9 (6)
Midi-Pyrénées Languedoc-Roussillon	4 (3)
Bourgogne-Franche-Comté	4 (3)
Mode d'exercice	
Libéral	68 (46)
Public	79 (54)

Pratiques de dépistage de *Staphylococcus aureus* avant chirurgie orthopédique



Gagneux-Brunon et al., JNI 2019

En pratique dans les centres…..ce qui est fait

- Etude auprès du CRIOAC de Lyon et de la SFHG:

	N =72 (%)
Décolonisation sans dépistage	6 (8)
Contexte de dépistage (n=66) Chirurgie programmée uniquement Chirurgie programmée et urgente	 45 (68) 21 (32)
Dépistage uniquement en cas de mise en place de matériel (prothèse et/ou ostéosynthèse) (n=66)	45 (68)
Protocole Mupirocine nasale/Chlorhexidine	13 (18)
Mupirocine nasale seule	30 (42)
Dépistage réalisé uniquement à l'initiative du chirurgien (n=66)	34 (51)
Respect recommandations OMS (Dépistage et décolonisation avec Mupirocine seule ou associée à la Chlorhexidine)	37 (51)

- Les méthodes de dépistage et les protocoles de décolonisation utilisés sont hétérogènes.
- Aucune différence n'a été observée entre les pratiques de praticiens exerçant en secteur public et ceux exerçant en secteur privé que ce soit pour le dépistage ou pour la décolonisation.

Gagneux-Brunon et al., JNI 2019

Journal of Hospital Infection 106 (2020) 332–334

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevier.com/locate/jhin

ELSEVIER

Healthcare Infection Society

Short Report

Staphylococcus aureus nasal decolonization before cardiac and orthopaedic surgeries: first descriptive survey in France

C. Ong [a], J-C. Lucet [b], C. Bourigault [a], G. Birgand [c], S. Aho [d], D. Lepelletier [a,e,*]

- Juin-Septembre 2018
- 70 hopitaux ont répondu

64%

In orthopaedic surgery, 18 hospitals declared screening patients before surgery using sample culture ($N = 15$), polymerase chain reaction (PCR) ($N = 2$) or both ($N = 1$). Screening was performed during ($N = 9$) or after ($N = 6$) the preoperative surgical consultation. *S. aureus* nasal screening and decolonization strategies were heterogeneous: meticillin-susceptible *S. aureus* (MSSA)-positive patients only ($N = 12/18$), meticillin-resistant *S. aureus* (MRSA)-positive patients only ($N = 2$), and universal decolonization without prior screening ($N = 4$). All hospitals used mupirocin for nasal decolonization in association with bath or shower with chlorhexidine ($N = 8$) or povidone iodine scrub ($N = 4$).

Table I

Description of French hospital protocols for *Staphylococcus aureus* nasal decolonization before cardiac and orthopaedic surgeries

Infection control strategies	French hospitals ($N = 28$) /70=40%
Systematic screening for *S. aureus* nasal carriage before surgery	28 (100%)
Microbiological method	
Simple culture	22 (79.0%)
Rapid test (PCR)	2 (7.0%)
Both methods	4 (14.0%)
Prophylactic regimen	
Mupirocin alone	2 (7.0%)
Mupirocin with antiseptic body wash	26 (93.0%)
Decolonization daily strategy[a]	
The day before surgery/three days after	22 (79.0%)
Two days before/two days after	4 (14.0%)
Three days before/one day after	1 (3.5%)

PCR, polymerase chain reaction.

[a] One hospital reported starting the nasal decolonization at patient admission and stopping it if the nasal screening for *Staphylococcus aureus* colonization were negative.

Les problèmes pratiques et les questions existentielles…..

La vraie vie c'est plus compliqué que les essais!

Pathologie Biologie 58 (2010) 127–130

ELSEVIER MASSON

Disponible en ligne sur ScienceDirect www.sciencedirect.com

Le dépistage en ambulatoire des patients port
présentant une colonisation urinaire et devant
orthopédique est-il réaliste ?

Is it possible to detect Staphylococcus aureus *coloniz*
surgery hospitalization?

O. Bajolet [a,*], E. Toussaint [a], S. Diallo [b], V. Vernet-Garnier [a], I

RÉSUMÉ

But de l'étude. – Évaluer la faisabilité de la réalisation en externe de la recherche de *Staphylococcus aureus* au niveau nasal et d'un examen cytobactériologique des urines (ECBU) dans une population de patients devant bénéficier d'une chirurgie orthopédique afin de réaliser une chimiodécontamination nasale et cutanée en cas de colonisation à *S. aureus* et un traitement des bactériuries en amont de l'hospitalisation.
Méthodes. – Inclusion des patients devant bénéficier d'une chirurgie orthopédique réglée de type prothèse de hanche, prothèse de genou, chirurgie du rachis avec mise en place de matériel, entre le 1er octobre 2007 et le 30 juin 2008 (réalisation des examens biologiques en externe). Une procédure de chimiodécontamination nasale et cutanée était remise au patient et communiquée au médecin traitant en cas de résultat positif.
Résultats. – Les résultats des examens biologiques pour au moins un des deux examens ont été obtenus pour 240 patients sur 263 inclus. Seuls 21,4 % des patients (48 positifs/224 recherches) étaient colonisés à *S. aureus* dont trois à *S. aureus* résistant à la méticilline. Parmi les patients colonisés à *S. aureus*, 70,8 % ($n = 34$) ont bénéficié d'une chimiodécontamination nasale et cutanée. Les patients (8,9 %, 20/225) présentaient une bactériurie, le micro-organisme le plus fréquemment isolé étant *Escherichia coli* ($n = 16$).
Conclusion. – Si la recherche et la gestion de la colonisation à *S. aureus*, ainsi que celle des bactériuries chez les patients bénéficiant d'une chirurgie orthopédique est possible en externe, le suivi des dossiers par une personne de l'établissement de soins est impératif.

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Antimicrobial Stewardship & Healthcare Epidemiology (2021), **1**, e63, 1–3
doi:10.1017/ash.2021.214

Concise Communication

Implementation of a surgical site infection prevention bundle: Patient adherence and experience

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Table 1. Characteristics of Surveyed Patients by Chlorhexidine Gluconate (CHG) and Mupirocin Adherence

Characteristic	Fully Adherent with CHG (n=65), No. (%)	Not Fully Adherent with CHG (n=11), No. (%)	Total (n=76), No. (%)	Fully Adherent with Mupirocin (n=9), No. (%)	Not Fully Adherent with Mupirocin (n=8), No. (%)	Total (n=17), No. (%)
Prior history of *Staphylococcus* infection among self or friend	24 (36.9)	4 (36.3)	28 (36.8)	3 (33.3)	5 (62.5)	8 (47.1)
Received product from						
Hospital Pharmacy	58 (89.2)	7 (63.6)	65 (85.5)	9 (100)	5 (62.5)	14 (82.4)
Mail	3 (4.6)	2 (18.2)	5 (6.6)	0	2 (25.0)	2 (11.8)
Other	4 (6.2)	2 (18.2)	6 (7.9)	0	1 (12.5)	1 (5.9)
Remembered receiving instructions for use	63 (96.9)	9 (81.8)	72 (94.7)	9 (100)	8 (100)	17 (100)
Reported ≥1 barrier to use	2 (3.1)	4 (36.4)	6 (7.9)	0	1 (12.5)	1 (5.9)
Experienced side effect(s)	6 (9.2)	2 (18.2)	8 (10.5)	2 (22.2)	3 (37.5)	5 (29.4)
Age, median y (IQR)	69 (60–72)	70 (67–72)	69 (60–72)	68 (63–70)	74 (69–77)	70 (67–74)
More than high school degree	40 (61.5)	8 (72.7)	48 (63.2)	7 (77.8)	5 (62.5)	12 (71.6)
Annual income >$25,000[a]	50 (79.4)	8 (72.7)	58 (76.3)	8 (88.9)	3 (37.5)	11 (64.7)
Willing to use again	65 (100)	10 (90.1)	75 (98.6)	9 (100)	8 (100)	17 (100)

Note. IQR, interquartile range.
[a]1 person preferred not to answer in mupirocin analysis; 3 people preferred not to answer in CHG analysis.

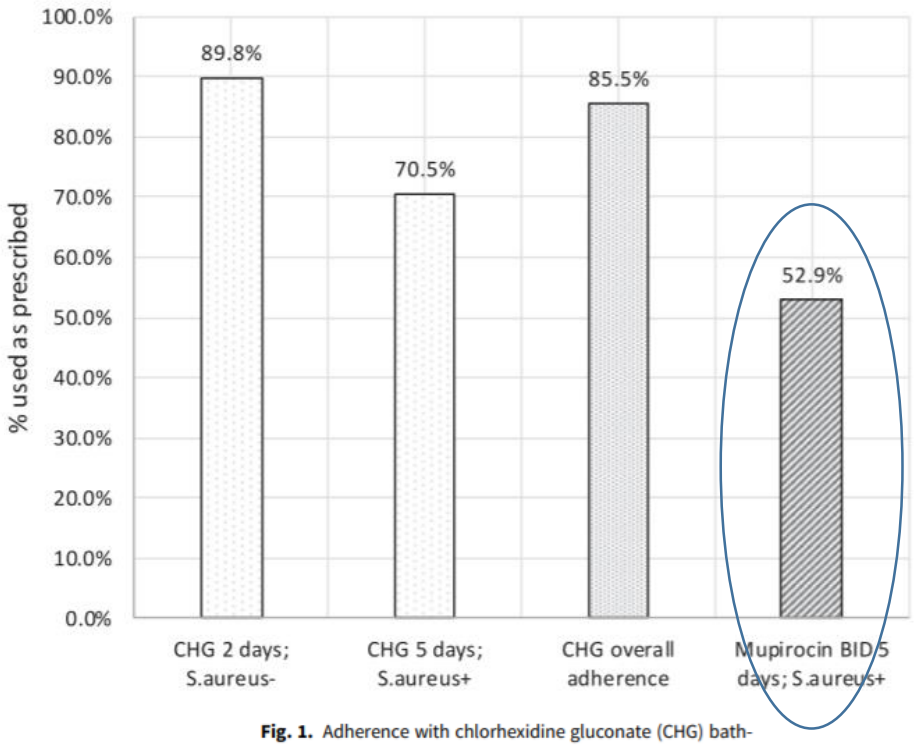

Fig. 1. Adherence with chlorhexidine gluconate (CHG) bathing and mupirocin by methicillin-resistant *S. aureus* (MRSA) and methicillin-susceptible *S. aureus* (MSSA) carrier status.

J Antimicrob Chemother 2020; **75**: 1623–1630
doi:10.1093/jac/dkaa025 Advance Access publication 25 February 2020

Journal of Antimicrobial Chemotherapy

Evaluation of effectiveness and compliance with the mupirocin nasal ointment part of *Staphylococcus aureus* decolonization in real life using UPLC-MS/MS mupirocin quantification

Roxane Nicolas[1,2], Anne Carricajo[2,3], Jérôme Morel[1], Josselin Rigaill[2,3], Florence Grattard[2,3], Salim Guezzou[3], Estelle Audoux[2], Salvatore Campisi[4], Jean-Pierre Favre[4], Philippe Berthelot[2,3,5], Paul O. Verhoeven [2,3] and Elisabeth Botelho-Nevers [2,5]*

Chirurgie cardiaque

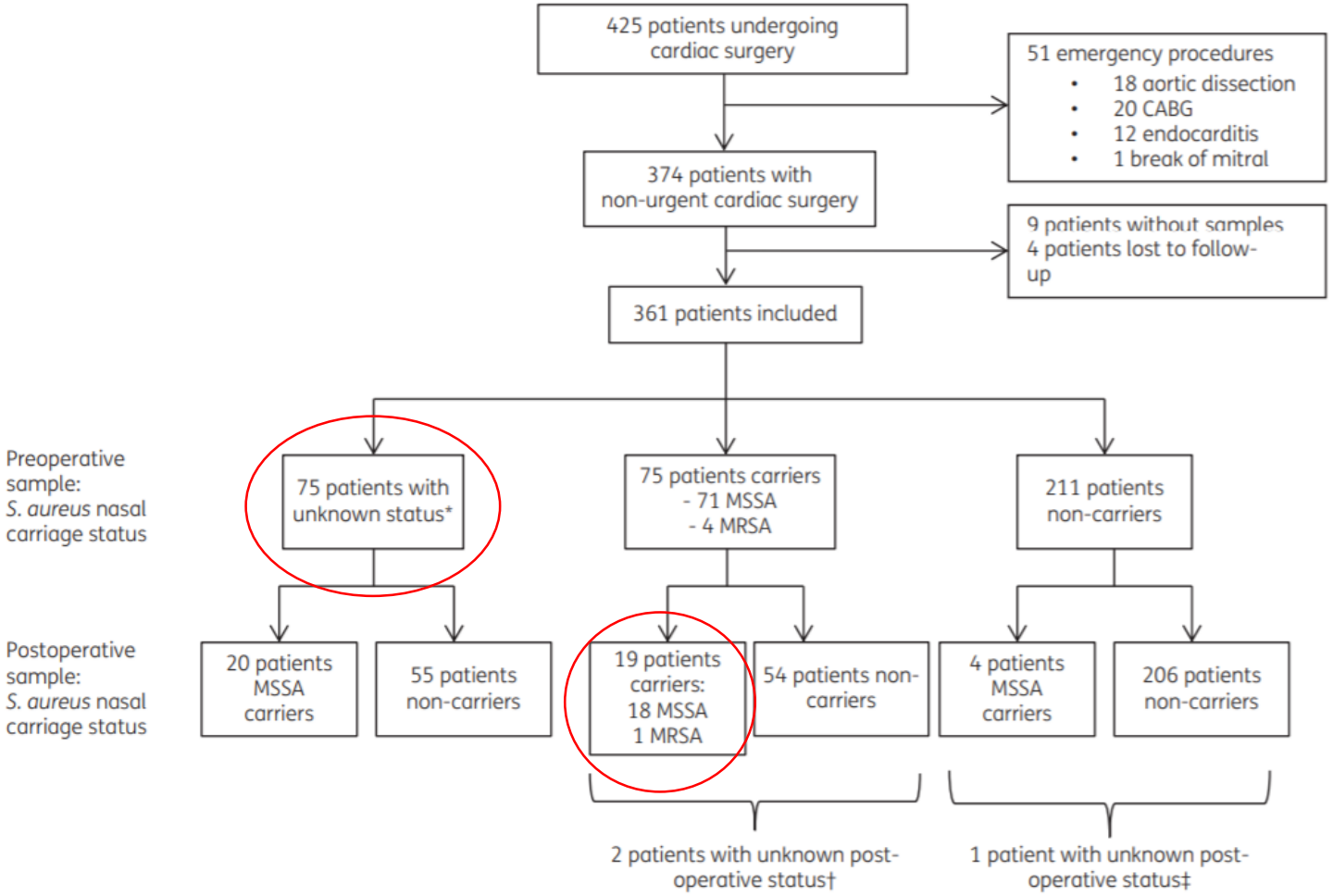

Table 2. Characteristics of *S. aureus* nasal carriers effectively decolonized and those who failed to be decolonized

	Results of postoperative *S. aureus* nasal carriage status among preoperative carriers[a]		
Characteristics	absence of carriage (successfully decolonized, *N* = 54)	presence of carriage (protocol failure, *N* = 19)	*P* value
Male, *n* (%)	40 (74)	10 (52.6)	NS
Age, years, mean (±SD)	65.5 (±10.7)	62.3 (±13.6)	NS
BMI, kg/m^2, mean (±SD)	27.4 (±5.6)	27.3 (±5)	NS
Current tobacco use, *n* (%)	8 (14.8)	7 (36.8)	0.05
Diabetes mellitus, *n* (%)	13 (24.1)	6 (31.5)	NS
Immunosuppressive therapy use, *n* (%)	2 (3.7)	2 (10.5)	NS
Charlson score, mean (±SD)	3.9 (±1.9)	4.3 (±2.4)	NS
Hospitalization in the previous month, *n* (%)	0	2 (10.5)	NS
Antibiotherapy in the previous month, *n* (%)	0	0	NS
IGS2, mean (±SD)	30 (±12.4)	27.6 (±13.7)	NS
Death, *n* (%)	1 (1.8)	0	NS
Surgical intervention, *n* (%)			
CABG	28 (51.9)	14 (73.7)	
aortic valve	6 (11)	2 (10.5)	
mitral valve	10 (18)	2 (10.5)	
valve + CABG	5 (9)	1 (5.3)	
double valve	2 (3.7)	0	
Bentall	3 (5.5)	0	
Extracorporeal circulation time, min, mean (±SD)	115 (±52.9)	99.7 (±26.4)	NS
Good compliance declared, *n/N* (%)	41/46 (89.1)	3/15 (20)	<0.0001
Dosable mupirocin, *n/N* (%)	24/46 (52.2)	2/16 (12.5)	0.005
Dosable monic acid, *n/N* (%)	8/48 (16.7)	0/17 (0)	0.075
S. aureus infection, *n* (%)	0	2 (10.5)	0.06

Décolonisation n'est pas une assurance tout risque?

Prior *Staphylococcus Aureus* Nasal Colonization: A Risk Factor for Surgical Site Infections Following Decolonization

J Am Acad Orthop Surg. 2016 Dec;24(12):880-885

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Anna Stachel, MPH
Michael Phillips, MD
Jonathan Vigdorchik, MD
James Slover, MD, MS
Joseph A. Bosco, MD

Abstract

Introduction: *Staphylococcus aureus (S aureus)* decolonization regimens are being used to mitigate the risk of surgical site infection (SSI). However, their efficacy is controversial, with mixed results reported in the literature.

Methods: Before undergoing primary total knee arthroplasty (TKA), total hip arthroplasty (THA), or spinal fusion, 13,828 consecutive patients were screened for nasal *S aureus* and underwent a preoperative decolonization regimen. Infection rates of colonized and noncolonized patients were compared using unadjusted logistic regression. An adjusted regression analysis was performed to determine independent risk factors for SSI.

Results: The rate of SSI in colonized patients was 4.35% compared with only 2.39% in noncolonized patients. In our TKA cohort, unadjusted logistic regression identified *S aureus* colonization to be a significant risk factor for SSI (odds ratio [OR], 2.9; $P < 0.001$). After controlling for other potential confounders including age, body mass index, tobacco use, and American Society of Anesthesiologists score, an SSI was 3.8 times more likely to develop in patients colonized with *S aureus* (OR, 3.8; $P = 0.0025$). The THA and spine colonized patients trended toward higher risk in both unadjusted and adjusted models; however, the results were not statistically significant.

Discussion: The results of our study suggest that decolonization may not be fully protective against SSI. The risk of infection after decolonization is not lowered to the baseline of a noncolonized patient.

Level of Evidence: Level IV

-Echec de décolonisation ou bien présence d'autres sites de portage possible non détectés par seul écouvillon nasal pouvant être associés à un sur-risque

Décolonisation universelle ou ciblée?

Chirurgie cardiaque: ~40 000/an
Chirurgie orthopédique: > 230 000/an

The Journal of Arthroplasty xxx (2016) 1–8

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journal homepage: www.arthroplastyjournal.org

Original Article

Decreased Hospital Costs and Surgical Site Infection Incidence With a Universal Decolonization Protocol in Primary Total Joint Arthroplasty

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ABSTRACT

Background: *Staphylococcus aureus* colonization has been identified as a key modifiable risk factor in the reduction of surgical site infections (SSI) related to elective total joint arthroplasty (TJA). We investigated the incidence of SSIs and cost-effectiveness of a universal decolonization protocol without screening consisting of nasal mupirocin and chlorhexidine before elective TJA compared to a program in which all subjects were screened for *S aureus* and selectively treated if positive.

Methods: We reviewed 4186 primary TJAs from March 2011 through July 2015. Patients were divided into 2 cohorts based on the decolonization regimen used. Before May 2013, 1981 TJA patients were treated under a "screen and treat" program while the subsequent 2205 patients were treated under the universal protocol. We excluded the 3 months around the transition to control for treatment bias. Outcomes of interest included SSI and total hospital costs.

Results: With a universal decolonization protocol, there was a significant decrease in both the overall SSI rate (5 vs 15 cases; 0.2% vs 0.8%; $P = .013$) and SSIs caused by *S aureus* organisms (2 vs 10; 0.09% vs 0.5%; $P = .01$). A cost analysis accounting for the cost to administer the universal regimen demonstrated an actual savings of $717,205.59. TJA complicated by SSI costs 4.6× more to treat than that of an uncomplicated primary TJA.

Conclusion: Our universal decolonization paradigm for elective TJA is effective in reducing the overall rate of SSIs and promoting economic gains for the health system related to the downstream savings accrued from limiting future reoperations and hospitalizations.

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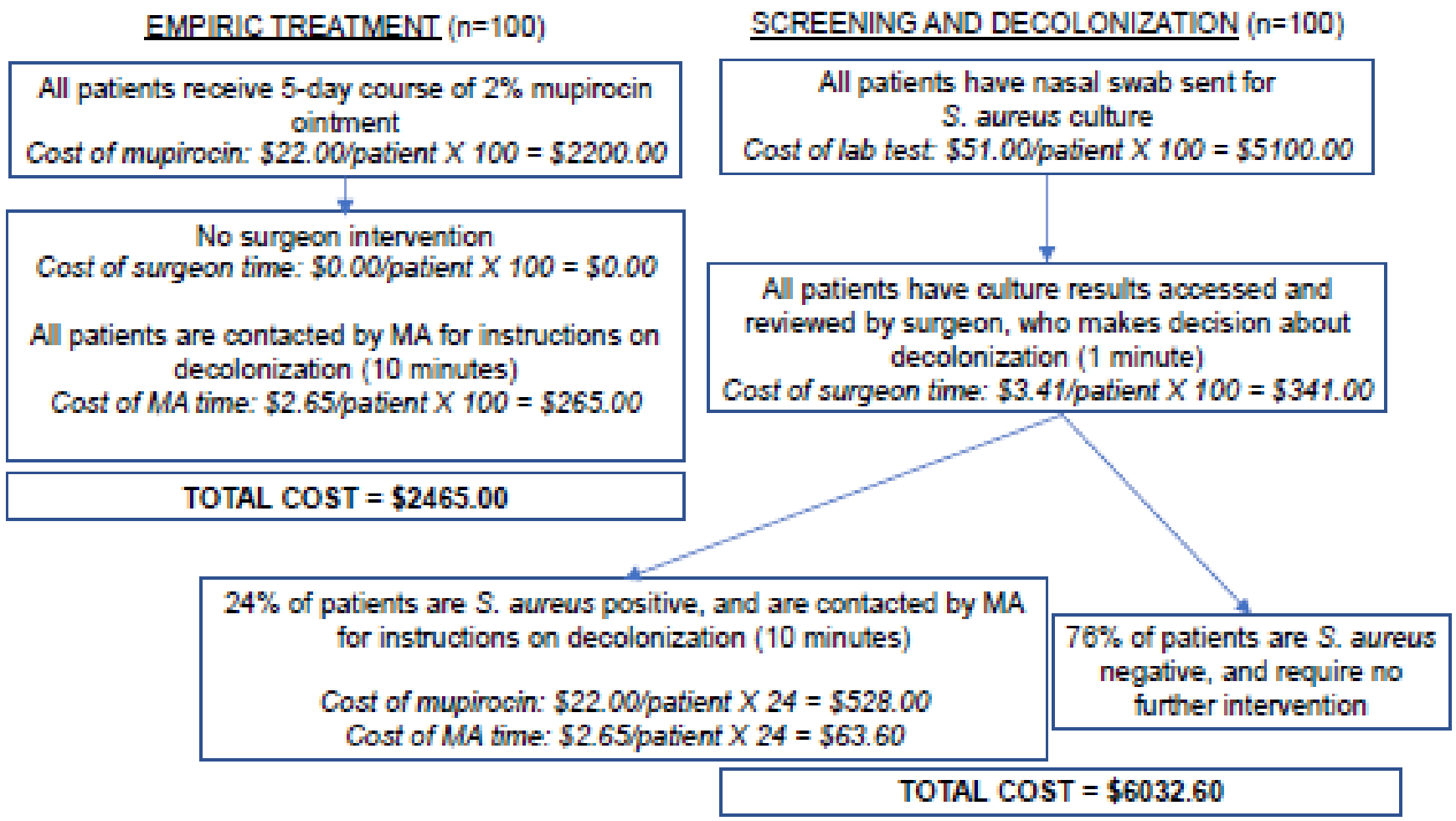

Figure 1. Workflow and cost calculation for empiric mupirocin treatment versus screening and decolonization in 100 TJA patients.

Stirton J,et al., Arthroplast Today. 2017 Dec 30;4(3):323-324

Quel impact écologique?

JCM
Journals.ASM.org

Mupirocin Resistance in Isolates of *Staphylococcus* spp. from Nasal Swabs in a Tertiary Hospital in France

2015

Sophie Trouillet-Assant,[a,c] Sacha Flammier,[a,c] Anais Sapin,[a,c] Céline Dupieux,[a,b,c] Oana Dumitrescu,[a,b,c] Anne Tristan,[a,b,c] François Vandenesch,[a,b,c] Jean-Philippe Rasigade,[a,b,c] Frederic Laurent[a,b,c]

Department of Clinical Microbiology, Hospices Civils de Lyon, Lyon, France[a]; National Reference Center for Staphylococci, Lyon, France[b]; International C Research, INSERM U1111, CNRS UMR5308, University of Lyon 1, ENS de Lyon, Lyon, France[c]

Prevalence of methicillin and mupirocin resistance, including low- and high-level resistance, among *S. aureus* and coagulase-negative staphylococcal strains found in intensive care units and orthopedic surgery wards

Staphylococcal strain[a]		No. (%) of strains in[b]:		*P* value[c]	Total no. (%) ($n = 635$)
		OS patients ($n = 318$)	ICU patients ($n = 317$)		
S. aureus		36 (11.3)	49 (15.4)	NS	85 (13.4)
	MRSA	1 (0.3)	7 (2.2)	<0.05	8 (1.3)
	LMupR	0 (0.0)	0 (0.0)	NS	0 (0.0)
	HMupR	0 (0.0)	0 (0.0)	NS	0 (0.0)
CoNS		282 (88.7)	268 (84.5)	NS	550 (86.6)
	MRCoNS	67 (21.1)	194 (61.2)	<0.001	261 (41.1)
	LMupR	1 (0.3)	11 (3.5)	<0.01	12 (1.9)
	HMupR	20 (6.3)	11 (3.5)	NS	31 (4.9)

Et la résistance dans tout cela?

J Antimicrob Chemother 2015; **70**: 1182–1184
doi:10.1093/jac/dku522 Advance Access publication 23 December 2014

Journal of Antimicrobial Chemotherapy

Acquisition of high-level mupirocin resistance in CoNS following nasal decolonization with mupirocin

David J. Hetem[1]*, H. Charles Vogely[2], Tim T. Severs[1], Annet Troelstra[1], Johannes G. Kusters[1] and Marc J. M. Bonten[1,3]

Table 1. Main results: detection of mupirocin-resistant CoNS in 936 surgical patients with nasal samples taken at T1 and T2

	Mupirocin-resistant CoNS	
	T1	T2
All patients ($n=936$)	192	406
high-level resistance	179	400
intermediate resistance	13	6
Patients without colonization at T1 ($n=744$)	0	277
high-level resistance at T2	0	273
intermediate resistance at T2	0	4
Patients colonized with mupirocin-resistant CoNS at T1	192	129

Journal of Antimicrobial Chemotherapy (2005) **56**, 1166–1168
doi:10.1093/jac/dki387
Advance Access publication 7 November 2005

JAC

In vivo transfer of high-level mupirocin resistance from *Staphylococcus epidermidis* to methicillin-resistant *Staphylococcus aureus* associated with failure of mupirocin prophylaxis

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Objectives: We examined the molecular basis of the emergence of mupirocin resistance in a methicillin-resistant *Staphylococcus aureus* (MRSA) strain colonizing a nursing home resident undergoing mupirocin prophylaxis.

Patient and methods: A persistent carrier of mupirocin-susceptible MRSA participated in a trial of mupirocin for nasal decolonization among nursing home residents. During prophylaxis a high-level mupirocin-resistant MRSA emerged in the nasal isolates from this patient. *S. aureus* and coagulase-negative staphylococci were isolated prior to, during and after 14 days of mupirocin treatment. The staphylococcal isolates and their plasmids were examined by molecular genetic methods.

Results: All mupirocin-susceptible and-resistant MRSA isolates possessed the same genotype. The patient was also colonized by a single mupirocin-resistant *Staphylococcus epidermidis* strain. The mupirocin-resistant MRSA and *S. epidermidis* strains harboured identical plasmids that carried the *mupA* determinant and genes for conjugative DNA transfer in staphylococci. These plasmids could be transferred *in vitro* from both clinical isolates to *S. aureus* RN2677.

Conclusions: The MRSA strain contained a conjugative plasmid expressing *mupA* that was identical with that found in the *S. epidermidis* strain which colonized the patient. These findings suggest that transfer of *mupA* from *S. epidermidis* to MRSA probably occurred during mupirocin prophylaxis.

Journal of Antimicrobial Chemotherapy (2003) **51**, 613–617
DOI: 10.1093/jac/dkg127
Advance Access publication 11 February 2003

JAC

Mupirocin and *Staphylococcus aureus*: a recent paradigm of emerging antibiotic resistance

A. Upton[1]*, S. Lang[2] and H. Heffernan[3]

[1]*Department of Infectious Diseases, Auckland Hospital, Private Bag 92024, Auckland;*
[2]*Department of Microbiology, Middlemore Hospital, Auckland;* [3]*Antibiotic Reference Laboratory, Institute of Environmental Science and Research, Wellington, New Zealand*

- SARM/ SAMS????
- Taux de base très élevé
- Toutefois doublement du
  résistance

Risque possible
A priori faible sur SAMS à ce stade
Quid en cas d'utilisation très large????

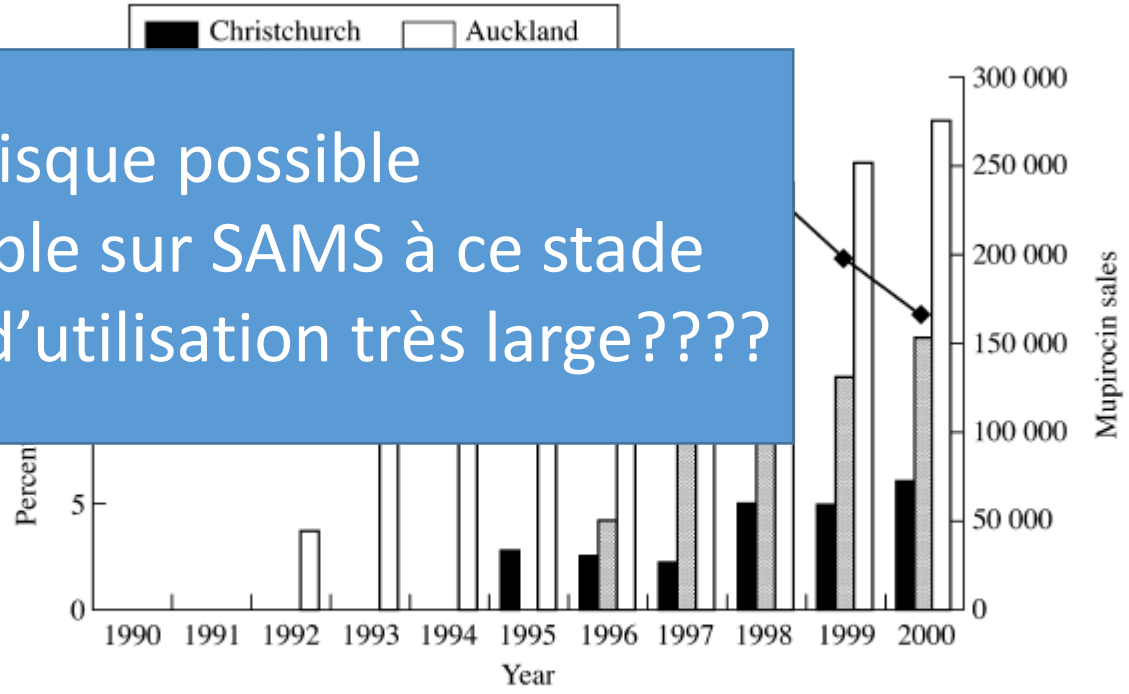

Figure 1. Mupirocin resistance among *S. aureus* isolates in hospital and community laboratories (Table 1, data source 1), and units of mupirocin sold per year, 1990–2000. No data were available for Christchurch and Auckland hospital laboratories, 1990–1994, or the Auckland community laboratory, 1990–1991.

AAC
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Prevalence of Chlorhexidine-Resistant Methicillin-Resistant *Staphylococcus aureus* following Prolonged Exposure

Carey D. Schlett,[a] Eugene V. Millar,[a] Katrina B. Crawford,[a] Tianyuan Cui,[a] Jeffrey B. Lanier,[b] David R. Tribble,[a] Michael W. Ellis[c]

Chlorhexidine has been increasingly utilized in outpatient settings to control methicillin-resistant *Staphylococcus aureus* (MRSA) outbreaks and as a component of programs for MRSA decolonization and prevention of skin and soft-tissue infections (SSTIs). The objective of this study was to determine the prevalence of chlorhexidine resistance in clinical and colonizing MRSA isolates obtained in the context of a community-based cluster-randomized controlled trial for SSTI prevention, during which 10,030 soldiers were issued chlorhexidine for body washing. We obtained epidemiological data on study participants and performed molecular analysis of MRSA isolates, including PCR assays for determinants of chlorhexidine resistance and high-level mupirocin resistance and pulsed-field gel electrophoresis (PFGE). During the study period, May 2010 to January 2012, we identified 720 MRSA isolates, of which 615 (85.4%) were available for molecular analysis, i.e., 341 clinical and 274 colonizing isolates. Overall, only 10 (1.6%) of 615 isolates were chlorhexidine resistant, including three from the chlorhexidine group and seven from nonchlorhexidine groups ($P > 0.99$). Five (1.5%) of the 341 clinical isolates and five (1.8%) of the 274 colonizing isolates harbored chlorhexidine resistance genes, and four (40%) of the 10 possessed genetic determinants for mupirocin resistance. All chlorhexidine-resistant isolates were USA300. The overall prevalence of chlorhexidine resistance in MRSA isolates obtained from our study participants was low. We found no association between extended chlorhexidine use and the prevalence of chlorhexidine-resistant MRSA isolates; however, continued surveillance is warranted, as this agent continues to be utilized for infection control and prevention efforts.

antibiotics

MDPI

Article

Reduced Susceptibility to Chlorhexidine among *Staphylococcus aureus* Isolates in Israel: Phenotypic and Genotypic Tolerance

Maya Azrad [1], Chen Shmuel [1], Tamar Leshem [1], Zohar Hamo [1], Moti Baum [2], Assaf Rokney [2], Keren Agay-Shay [3,†] and Avi Peretz [1,3,*,†]

Table 3. Clinical and epidemiological characteristics of CHG-tolerant vs. CHG-susceptible isolates.

Characteristic	Reduced Susceptibility to CHG		Total Isolates n = 190 n (%)	p-Value [1]
	Yes n = 25 n (%)	No n = 165 n (%)		
qac A/B presence				
Yes	10 (40)	15 (60)	25	**<0.0001** [2]
No	15 (9)	150 (81)	165	
Methicillin susceptibility				
Resistant (MRSA)	22 (24)	70 (76)	92	**<0.0001**
Sensitive (MSSA)	3 (3)	95 (97)	98	
Mupirocin susceptibility				
Resistant	7 (39)	11 (61)	18	**0.001**
Sensitive	18 (10.5)	154 (89.5)	172	
Mupirocin's MIC (mg/L)				
Mean	257.44	69.74	94.45	0.066
Median (Q1, Q3)	0.19 (0.125, 256)	0.064 (0.094, 0.25)	0.125 (0.094, 0.25)	
pvl presence				
Yes	4 (10.25)	35 (89.75)	39	**0.548**
No	21 (12.3)	130 (87.7)	171	
Sample source				
Blood culture	14 (21)	53 (79)	67	**0.020**
Wounds	11 (8.95)	112 (91.05)	123	

[1] Chi-squared test, Mann–Whitney test. [2] Bold values indicate statistical significance.

Et après on fait quoi????

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Decolonization in Prevention of Health Care-Associated Infections

Edward J. Septimus,[a,b] Marin L. Schweizer[c,d,e]

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Au total,

- Agir sur le portage de *S. aureus* pour prévenir les ISO*:* cela parait logique
- Il y a suffisamment de preuve pour décoloniser en chirurgie cardiaque
- « Contamination » progressive à l'orthopédie…..
- Besoin de recommandations nationales (≠OMS): faille avec de potentiels effets écologiques!
- Tout cela ne doit pas faire oublier TOUTES les autres mesures de prévention des ISO.

Merci de votre attention