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Risk factors for *Staphylococcus aureus* surgical site infections after orthopedic surgery in a French university hospital

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Conflict of interest

- No conflict of interest, nothing to disclose

Background (1)

- Surgical site infections (SSI) following orthopedic surgery -> substantial morbidity rates, prolonged hospital stays, and increased healthcare costs

Whitehouse *et al.* *Infect Control Hosp Epidemiol.* 2002

Kurtz *et al.* *J Arthroplasty* 2012

- *Staphylococcus aureus* -> the most common microbial cause

Korol *et al.* *PLoS ONE* 2013

Background (2)

- Risk factors for **monomicrobial *S. aureus* SSI** are not well-known:
 - High-level nasal carriage of *S. aureus*
 - Days from admission to operation ; re-interventions unrelated to infections; young age

Kalmeijer *et al.* *Infect Control Hosp Epidemiol.* 2000

Marimuthu *et al.* *Surg Infect.* 2015

- In France, systematic *S. aureus* screening and decolonization are not recommended before orthopedic surgery

Lepelletier *et al.* *Médecine Mal Infect.* 2014

Context

Grenoble Alpes University Hospital: > 6000 orthopedic surgery and traumatology / year



Objectives

To evaluate risk factors for monomicrobial *S. aureus* SSI after orthopedic surgery in a French University Hospital

Setting & design

Period and Setting

- January 2012 – April 2015
- Grenoble Alpes University Hospital, Grenoble (France)



Design

- Prospective cohort study
 - Inclusion criteria:
 - Hip arthroplasty,
 - Knee arthroplasty,
 - Revision of hip arthroplasty,
 - Revision of knee arthroplasty,
 - Osteosynthesis
 - Exclusion criteria:
 - Hand surgery
 - Scaphoid surgery
 - Carpal surgery
 - Surgery for infection or revision for infection
 - Patients < 16 years of age

Definitions

Nested case-control study, definitions:

- Case: patients with monomicrobial *S. aureus* SSI
- Control: patients without SSI

SSI, definitions:

- U.S. Centers for Disease Control and Prevention (CDC) criteria
- Survey for one year following surgery

Horan *et al.* *Am J Infect Control.* 2008

Data collection & analysis

Data collection

- Data were collected prospectively by accessing electronic medical records:
 - Demographic and clinical information
 - Pre, peri and post operative data

Statistical analysis

- Matching case/control (1/2) on year of intervention, age, sex, and similar procedure
- Univariate analysis
- Unconditional logistic regression model

Flow chart of patient inclusion

Patients followed prospectively post-surgery (n= 10132)

Excluded:

Non orthopedic surgery: n=2422

Hand, scaphoid and carpal surgery: n=203

Patients <16 years of age: n=69

Selected interventions (n= 7438)

S. aureus SSI (n=50)

No SSI (n=7301)

Non-*S. aureus* SSI (n=87)

Flow chart of patient inclusion

Patients followed prospectively post-surgery (n= 10132)

Excluded:

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Patients <16 years of age: n=69

SSI rate: 1.8%

***S. aureus* SSI rate: 0.7%**

Selected interventions (n= 7438)

S. aureus SSI (n=50)

No SSI (n=7301)

Non-*S. aureus* SSI (n=87)

S. aureus SSI

Characteristics	n=50
Site of SSI, n (%)	
Superficial	7 (14)
Deep	35 (70)
Organ and/or space	8 (16)
Microbiology, n (%)	
Methicillin-sensitive <i>S. aureus</i>	46 (92)
Methicillin-resistant <i>S. aureus</i>	4 (8)
Median delay between intervention and SSI, days (IQR)	29.5 (20-61)
Re-intervention for SSI, n (%)	43 (86)
Antibiotic treatment, n (%)	45 (91,8)

Univariate analysis

⇒ 46 cases - 91 controls

Characteristics	n=137
Gender (female), n (%)	72 (52.6)
Median age, years (IQR)	70.3 (57-84.6)
Charlson score, n(%)	
0	86 (62.8)
1-2	34 (24.8)
3-4	9 (6.6)
≥5	8 (5.8)
Type of surgery, n(%)	
Hip arthroplasty	23 (16.8)
Knee arthroplasty	21 (15.3)
Revision of hip or knee arthroplasty	7 (5.1)
Osteosynthesis	86 (62.8)
Fracture, n(%)	100 (73)

Univariate analysis

Characteristics n(%)	Case n=46	Control n=91	P-value
Diabetes	9 (19.6)	7 (7.7)	0.04
Hemiplegy or paraplegy	3 (6.5)	0 (0)	0.04
NNISS score			
0	8 (17.4)	41 (46.6)	0.001
1 or 2	38 (82.6)	47 (53.4)	
Antibioprophylaxis with a non-appropriate drug	3/42 (7.1)	0/90 (0)	0.03
Bathing with antiseptic soap			
0	26 (56.5)	19 (20.9)	0.01
1 ou 2	20 (43.5)	72 (79.1)	
Smoking	10 (21.7)	9 (9.9)	0.06

Multivariate analysis

Variables	Adjusted odds ratio	95 % confidence intervals	P-value
NNISS score ≥ 1	5.77	1.75-19.05	0.004
Smoking	8.35	1.17-59.60	0.03
Bathing with antiseptic soap ≥ 1	0.26	0.12-0.65	0.003
Diabetes	3.24	0.93-11.31	0.07

Discussion

- Our risk factors of *S. aureus* SSI are different from previous studies
- Comparison with literature:
 - Bathing with antiseptic soap *Webster et al. Cochrane Database Syst Rev. 2015*
 - Smoking *Claessen et al. Clin Orthop. 2016*
- Colonization with *S. aureus* cannot be studied in our study
- Place of nasal carriage need to be explore

Conclusions

- In our population, *S. aureus* SSI represents one third of SSI after orthopedic surgery
- It seems imperative to recall the importance of **preoperative showers** and **smoking cessation** before orthopedic surgery



Conclusions



- In our population, *S. aureus* SSI represents one third of SSI after orthopedic surgery
- It seems imperative to recall the importance of **preoperative showers** and **smoking cessation** before orthopedic surgery
- Furthermore, the risk factors identified from our study can be used to identify high risk patients for *S. aureus* SSI that will benefit from *S. aureus* screening and decolonization

Humphreys et al. *J Hosp Infect.* 2016

Thank you for your attention

