



# The microbial epidemiology of breast implant infections in a regional referral centre for plastic and reconstructive surgery in the south of France



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## SUMMARY

**Background:** Breast implant infections are usually caused by *Staphylococcus aureus* and coagulase-negative staphylococci. Gram-negative bacilli are rarely reported to be involved in breast implant infections.

**Methods:** Thirty-seven cases of microbiologically confirmed breast implant infection managed from January 2008 to June 2012 in the study centre were reviewed, including 10 cases from the study centre itself and 27 cases from private clinics in the region.

**Results:** The prevalence of breast implant infection in the study centre was 0.74% of breast implantation, i.e., 3.23% in breast reconstruction for breast cancer and 0.27% in aesthetic breast augmentation ( $p = 0.0002$ ). Of the 37 cases, 30% had undergone radiotherapy and 11% had undergone a lymph node dissection. *S. aureus* was identified in 18 cases, Gram-negative bacilli in 10 cases, coagulase-negative staphylococci in eight cases, anaerobic bacteria in eight cases, and streptococci in three cases. *Pseudomonas aeruginosa* was the second most commonly identified pathogen. *Staphylococcus epidermidis* was the most frequent coagulase-negative Staphylococcus species. In addition to *Propionibacterium acnes* and *Actinomyces neuii*, other facultative and strict anaerobic bacteria have not been reported before, e.g., *Bacteroides thetaiotaomicron*, *Corynebacterium simulans*, *Dermabacter hominis*, *Fingoldia magna*, and *Peptoniphilus harei*. Seventy-percent of cases were treated by immediate implant removal. All cases treated only with antibiotics were treated with surgery at the second visit.

**Conclusions:** The microbiological epidemiology was noted by an increasing the proportion of Gram-negative bacteria and anaerobic bacteria detected with the advent of MALDI-TOF MS and molecular identification for diagnosis.

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## 1. Introduction

Breast implant infection is a complication after breast augmentation that occurs in 2–53% of cases.<sup>1,2</sup> The incidence is higher in breast reconstruction after surgery for breast cancer than

in aesthetic breast augmentation.<sup>2–4</sup> In previous years, common pathogens of breast implant infection have been *Staphylococcus aureus* and coagulase-negative staphylococci.<sup>2</sup> Atypical mycobacteria have been reported as pathogens involved in many breast implant infection outbreaks.<sup>5–9</sup> Few studies have reported breast implant infections caused by Gram-negative bacilli.<sup>2,10</sup>

There are some well known risk factors for breast implant infection, including obesity, diabetes mellitus, renal failure, active skin disorders, and tobacco use. The risk is increased in patients undergoing mastectomy, axillary dissection, or chemotherapy, as well as those who have undergone prior radiation treatment, reoperations, operations lasting longer than 2 h, or drain placement.<sup>2</sup>

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The diagnosis of breast implant infection may be difficult in the absence of scar discharge, purulent flow, cellulitis, or abscesses. Despite improvements in the recognition of breast implant infections, management strategies vary widely across centres, particularly with regards to the choice and duration of antimicrobial treatment and when to remove the breast implants.<sup>2</sup> However, some authors have reported one-time exchanges of the breast implants using antibiotics.<sup>11</sup>

The early and accurate identification of bacteria is a critical requirement for prompt and appropriate antimicrobial treatment of breast implant infections.<sup>12</sup> The arrival of matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) in the study centre has increased the speed and identification of the common and rare bacterial species involved in human infection.<sup>13</sup>

In this study, the clinical and microbiological features of breast implant infections managed in a regional referral centre for plastic/reconstructive surgery in the south of France were reviewed retrospectively.

## 2. Materials and methods

A review was performed of all breast implant infection cases managed from January 2008 to June 2012 in a regional referral centre for plastic/reconstructive surgery in the south of France. A total of 1350 breast implant surgeries were performed in the study centre during the study period, including 217 definitive implants for reconstruction and 1133 aesthetic breast augmentations. The study centre also supports patients with breast implant infections for whom the breast implant surgery was performed in private clinics in the region.

The following data were collected: patient clinical characteristics (i.e., age, comorbidities, use of tobacco, previous radiotherapy, adjuvant chemotherapy, and lymphadenectomy) and past surgical history (i.e., aesthetic or reconstruction, type of incision, and type of implant). The timing of onset of the infection, clinical signs, and microbiological results were also recorded. An acute breast implant infection was defined by the appearance of clinical signs  $\leq 6$  weeks after the implantation; a late breast implant infection was defined by the appearance of clinical signs  $> 6$  weeks after the implantation.<sup>1,2</sup> The antimicrobial and/or surgical treatment approaches used in each case were reviewed. The treatment outcome was evaluated at 3, 6, 12, and 24 months after the end of treatment. This study was approved by the institutional research ethics board and written informed consent was obtained from each patient.

The diagnosis of breast implant infection was based on the patient's medical history, including clinical evidence of infection from biological and/or radiological data, and at least two positive cultures from deep surgical or percutaneous biopsy samples to exclude contaminating bacteria, as described previously.<sup>13</sup> After incubation, the bacteria were identified through MALDI-TOF MS (Bruker Daltonik), as described previously.<sup>13</sup> Complete 16S rRNA gene sequencing was performed for unknown anaerobic bacteria not identified by MALDI-TOF MS, as described previously.<sup>13</sup> The antibiotic susceptibilities of bacterial isolates were determined and interpreted according to the recommendations of the French Society for Microbiology and the European Committee on Antimicrobial Susceptibility Testing ([http://www.sfm-microbiologie.org/UserFiles/files/casfm/CASFM\\_EUCAST\\_V1\\_0\\_2014.pdf](http://www.sfm-microbiologie.org/UserFiles/files/casfm/CASFM_EUCAST_V1_0_2014.pdf)). The susceptibility of Staphylococcus isolates to methicillin was screened by agar diffusion using cefoxitin disks (BioRad, Carnes-La-Coquette, France).

The antimicrobial and/or surgical treatment approaches used and the final outcome of each case were reviewed. Treatment was considered successful when there was remission, i.e., the

disappearance of all breast infection symptoms after the end of antibiotic treatment. Relapse was defined by the reappearance of active breast implant infection symptoms at any time following treatment.

Data analyses were performed using IBM SPSS Statistics, version 20.0 software (IBM Corp., Armonk, NY, USA). Proportions were compared using the Chi-square test or Fisher's exact two-tailed test. A  $p$ -value of  $< 0.05$  was considered statistically significant.

## 3. Results

A total of 37 cases of microbiologically confirmed breast implant infection were managed in the study centre. Of the 37 breast implant infection cases, 14 (38%) had undergone breast implant placement for reconstruction after breast cancer and 23 (62%) had undergone placement for aesthetic breast augmentation. Forty-eight percent of patients with aesthetic breast augmentations had undergone repeat implant placement.

Ten breast implant infections involved patients from the study centre, representing 0.74% of breast implantations; these included seven cases (3.23%) of breast reconstruction for breast cancer and three cases (0.27%) of aesthetic breast augmentation. The prevalence of breast implant infection was significantly higher in the group of patients who had breast implants placed for reconstruction after breast cancer ( $p = 0.0002$ ). Twenty-seven other breast implant infection cases were from private clinics in the region, including seven cases in breast reconstruction for breast cancer and 20 cases in aesthetic breast augmentation.

Silicone implants were used in 81% of cases, while saline serum implants were used in 19% of cases. In all 37 cases, the breast implants were inserted in the retromuscular space at the level of the periosteum, through the inframammary fold in 50% of cases, through the mastectomy incision in 32%, and by axillary incisions in 18%.

The mean patient age was  $44 \pm 14$  years (range 19–76 years). Eleven patients (30%) were tobacco users, 11 patients (30%) had undergone radiotherapy for breast cancer, four patients (11%) had undergone a lymph node dissection for breast cancer, one patient had diabetes mellitus, two patients were on immunosuppressive therapy and/or corticosteroid treatment, and one patient was HIV-positive (Table 1).

Sixteen cases (43%) occurred at  $\leq 6$  weeks after the implantation and 21 cases (57%) occurred  $> 6$  weeks after the implantation. The median onset to diagnosis was 330 days (range 3–6120 days). Most cases were paucisymptomatic and the main symptoms were purulent flow or scar distension, which was present in 17 of the cases (46%), followed by abscess in 11 cases (30%), local cellulitis in six cases (16%), and fever in seven cases (19%). Biological parameters of inflammation, i.e., a high leukocyte count ( $> 12 \times 10^9/l$ ) and/or a high plasma C-reactive protein level ( $> 40$  mg/ml), were recorded in five of the cases (13%). There were four complications of breast implant infection: one toxic shock syndrome associated with a breast implant infection due to *Streptococcus pyogenes* and three cases of chronic rib osteomyelitis.

Among the 17 species of bacterial isolate ( $N = 47$ ) involved in breast implant infection, *S. aureus* was the most common, identified in 18 cases (49%), followed by Gram-negative bacteria in 10 cases (27%), coagulase-negative staphylococci in eight cases (22%), strict anaerobic bacteria in five cases (14%), facultative anaerobic bacteria in three cases (8%), and streptococci in three cases (8%). The five strict anaerobic bacteria identified in this study were *Propionibacterium acnes*, *Bacteroides thetaiotaomicron*, *Finegoldia magna*, and *Peptoniphilus harei*, and the three facultative anaerobic bacteria identified were *Dermabacter hominis*, *Corynebacterium simulans*, and *Actinomyces neuui*.

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