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Original article

Microbial flora on cell-phones in an orthopedic surgery room before and after decontamination

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ABSTRACT

Introduction: Cell-phones are the typical kind of object brought into the operating room from outside by hospital staff. A great effort is made to reduce the level of potentially contaminating bacteria in the operating room, and introducing these devices may run counter to good practice. The study hypothesis was that cell-phones are colonized by several strains of bacteria and may constitute a source of nosocomial contamination. The main study objective was to screen for bacterial colonies on the surfaces of cell-phones introduced in an orthopedic surgery room. The secondary objective was to assess the efficacy of decontamination.

Material and method: Samples were taken from the cell-phones of hospital staff (surgeons, anaesthetists, nurses, radiology operators, and external medical representatives) entering the operating room of the university hospital center orthopedic surgery department, Toulouse (France). Sampling used Count Tact® contact gel, without wiping the phone down in advance. Both sides of the phone were sampled, before and after decontamination with a pad imbibed with 0.25% Surfanios® Premium disinfectant. A nasal sample was also taken to investigate the correlation between *Staphylococcus aureus* in the nasal cavities and on the cell-phone.

Results: Fifty-two cell-phones were sampled. Before decontamination, the mean number of colony-forming units (CFU) was 258 per phone (range, 0–1,664). After decontamination, it was 127 (range, 0–800) ($P=0.0001$). Forty-nine cell-phones bore CFUs before decontamination (94%), and 39 after (75%) ($P=0.02$).

Discussion: Cell-phones are CFU carriers and may thus lead to contamination. Guidelines should be drawn up to encourage cleaning phones regularly and to reduce levels of use within the operating room.

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1. Introduction

Cell-phones are increasingly widespread in health centers, and even reach operating rooms.

They have several uses in medical practice: photography, medical documentation, both recorded and downloaded, work-related communication, etc.

Five to 21% of cell-phones belonging to care staff are reported to be bacterial reservoirs liable to cause nosocomial infection [1–6].

Recently, Morvai et al. [7] published a literature review of 30 articles for the period 2004–14. Cell-phone contamination rates ranged from 40% to 100%. Coagulase-negative staphylococcus and

Staphylococcus aureus were the most frequent bacteria and were partly (10–95.3%) methicillin-resistant.

Despite these data, there are no guidelines for the use and decontamination of cell-phones in the operating room or more generally inside health-care centers.

The main objective of the present study was to assess the bacterial contamination of cell-phones used by care-staff within an orthopedic surgery room.

The secondary objective was to compare bacterial flora before and after decontamination of the phone, and to determine users' cleaning habits, if any, on a questionnaire. Finally, a nasal sample was also taken, to assess the correlation between asymptomatic *S. aureus* carriage and cell-phone contamination.

The study hypothesis was that cell-phones introduced into the operating room carry bacteria that may be pathogenic, and that a standardized decontamination protocol significantly reduces bacterial load on the phone.

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2. Material and method

After securing consent, samples were taken from cell-phones that had been brought into the orthopedic surgery room of the Toulouse Purpan University Hospital by hospital staff: surgeons, anesthetists, nurses, radiology operators and also external medical representatives. There were no refusals to participate.

Samples were collected between July 9 and 23, 2015. A nasal sample was taken from the cell-phone owner at the same time.

Cell-phone owners filled out a questionnaire on their habits regarding use of and cleaning the phone and cleaning the hands after cell-phone use.

2.1. Sampling

Samples were taken from all phones by a single clinical research associate.

For sample collection, the phone was handled wearing sterile gloves, after decontaminating the hands by rubbing with a hydroalcoholic solution. Each staff member's phone was given a code number, to ensure anonymity.

Sample collection used Count Tact® contact gel, without wiping the phone down in advance. Both sides of the phone were sampled, before and after decontamination: i.e., 4 samples per phone.

Contact with the gel lasted 10 seconds per side.

For phones with a protection film or case, samples were taken from the film or case; if the front side of the phone was protected by a flip-front, the flip-front was raised and the sample taken from the screen.

Microbiology data were collected from the Purpan Hospital bacteriology laboratory (Dr. Grare).

Nasal samples were taken using the ESwab system.

2.2. Decontamination

After baseline sampling, the cell-phone underwent a standardized decontamination protocol drawn up by the hospital's hygiene physician (Dr. Malavaud), consisting in direct application of Surfianos® Premium disinfectant (N-(3-aminopropyl)-N-dodecylpropane-1 and didecyltrimethylammonium chloride) diluted to 0.25% (20 ml for 8L water) on a pad, for about 30 seconds. Surfianos® Premium is a floor and surface decontamination solution, frequently used in the operating room, with bactericidal action within 5 minutes, tuberculocidal action within 120 minutes, and yeasticidal action within 15 minutes.

2.3. Bacteriological findings

Bacteriological data were expressed as colony-forming units (CFU). Families and pathogenicity were identified. Bacterial strains were defined as pathogenic or not according to the Association for Professionals in Infection Control and Epidemiology (APIC) osteoarticular infection prevention guide (Table 1) [8].

Table 1
Pathogenic and non-pathogenic bacteria.

Pathogenic bacteria	Non-pathogenic bacteria
<i>Coagulase-negative Staphylococcus</i>	<i>Bacillus</i> species
<i>Viridans streptococcus</i>	<i>Micrococcus</i> species
<i>Staphylococcus aureus</i>	<i>Corynebacterium</i> species
<i>Enterococcus faecalis</i>	<i>Paracoccus yeei</i>
	<i>Pseudomonas oryzihabitans</i>
	<i>Lactobacillus</i> species

2.3.1. Statistical analysis

Statistical analysis used Student t or Wilcoxon tests depending on distribution normality according to Shapiro-Wilk test. Analyses were performed on Excel® (Microsoft, Redmond, Washington, USA) and XLSTAT 2012 software (Addinsoft, Paris, France).

3. Results

3.1. Study population

Fifty-two participants (Table 2) were included: 29 male (56%); mean age, 33 years (range, 22–62 years).

3.1.1. Questionnaire

Thirty-three percent (17) of participants reported systematically answering their phone when in the operating room.

Thirty percent often or very often consulted medical applications while working in the operating room.

Eighty-five percent considered their cell-phone to be important or very important professionally.

Thirty-four percent (18) decontaminated their phone regularly; 15 (29%) did so at least once a week, including 11 (21%) who used an alcohol solution; 87% did not disinfect their hands after using the phone (Table 3).

Nineteen percent (10) were symptom-free nasal carriers of *S. aureus*, including 1 case of methicillin-resistant *S. aureus*, without correlation with cell-phone contamination.

3.2. Bacteriology results

Before decontamination, total CFU count was 13,439 (4322 on the front side and 9117 on the back), for a mean 258 CFUs per phone (range, 0–1664). Phones with a flip-front had a mean 217 CFUs ($P > 0.05$).

After decontamination, total CFU count was 6614 (2600 on the front side and 4014 on the back), for a mean 127 CFUs per phone (range, 0–800); ($P = 0.0001$).

Forty-nine phones carried CFUs (94%) before decontamination, and 39 (75%) after ($P = 0.02$).

Results according to staff categories (gender, occupation, decontamination habits) are presented in Table 4.

Table 2
Participants' occupations.

Occupation	N = 52
Surgeon	24 (46%)
Anesthetist	9 (17%)
Radiology operator	9 (17%)
Nursing assistant	3 (6%)
Nurse	2 (4%)
Other (external medical representative)	5 (10%)

Table 3
Questionnaire responses.

Age of cell-phone	< 1 yr	22 (42%)
	> 3 yrs	11 (21%)
Have you been informed of the need to disinfect your cell-phone?	Yes	4 (8%)
	No	48 (92%)
Do you disinfect your cell-phone regularly?	Yes	18 (34%)
	No	34 (66%)
Do you systematically disinfect your hands after using your cell-phone?	Yes	7 (13%)
	No	45 (87%)
Do you think your cell-phone may carry pathogens?	Yes	45 (87%)
	No	7 (13%)

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