Evaluation of the XenexGerm-Zapping RobotsTM device (XenexGZR) in the control of environmental contamination in an Intensive Care Unit (ICU)

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Background

Multidrug-resistant organisms (MDRO) thrive in hospital environments. Cleaning the surfaces of the patient's surroundings contributes to reducing the risk of Healthcare-associated Infections (HAI). Routine cleaning and disinfection may be insufficient due to the complexity of hospital surfaces; recently, surface disinfection systems have been incorporated based on "non-touch" technologies such as ultraviolet light emitting robots.

Aim(s)/ Objective(s)

Describe our experience of using XenexGZR as a support in the routine cleaning in an ICU of a tertiary hospital in Barcelona, and to assess the impact on the microbiological environment load, presence of Multidrug-resistant organisms MDRO and *Clostridiodes difficile* (CDIFF).

Methods

A prospective study was carried out in two-bedded ICU rooms located on two different floors (24 rooms of up to two beds/ room), the XenexGZR robot was used as a complement to the usual cleaning, with cross-assignment and alternation for each floor for 8 months.
Environmental sampling was made weekly, including:

- air sampling with SAS microbiological air sampler: total count for per m^3 for aerobic microorganisms (using TSA agar) and fungi (sabouraud agar supplemented with antibiotics) and for each room (n=563)
- surface sampling in each of the beds with patient admitted (bed rails, patient and nursing tables, and medical device push buttons) to study the presence or absence of CDIFF and MDRO (*Staphylococcus aureus*, *Enterobacteriaceae*, *Enterococcus* spp. *Pseudomonas* spp. and *Acinetobacter* spp): number of surface samples: 2183 from 814 beds.

For the statistical analysis, the samples were categorized into three groups: **group 0** or control, with standard cleaning procedure (n = 456); **group 1**, with recent added use (<7 days) of XenexGZR (n=171), **group 2**, without recent use (> 7 days) of XenexGZR (n= 187).

The distribution of the samplings and differents groups is shown graphically in the attached diagram (figure 1)

Group 0 was compared with **group 1 (per protocol analysis)** and with **1 + 2 (intention-to-treat analysis).**

In order to evaluate the results according to the days of admission, the analysis was stratified according below or higher than median using statistics Mantel-Haenzel (R-commander program)

Statistical analysis: Chi-square or Fisher's exact test were used for categorical variables and the Student t-test and Mann-Whitney U tests for continuous variables. Results were considered significantly statistically if p<0.05.

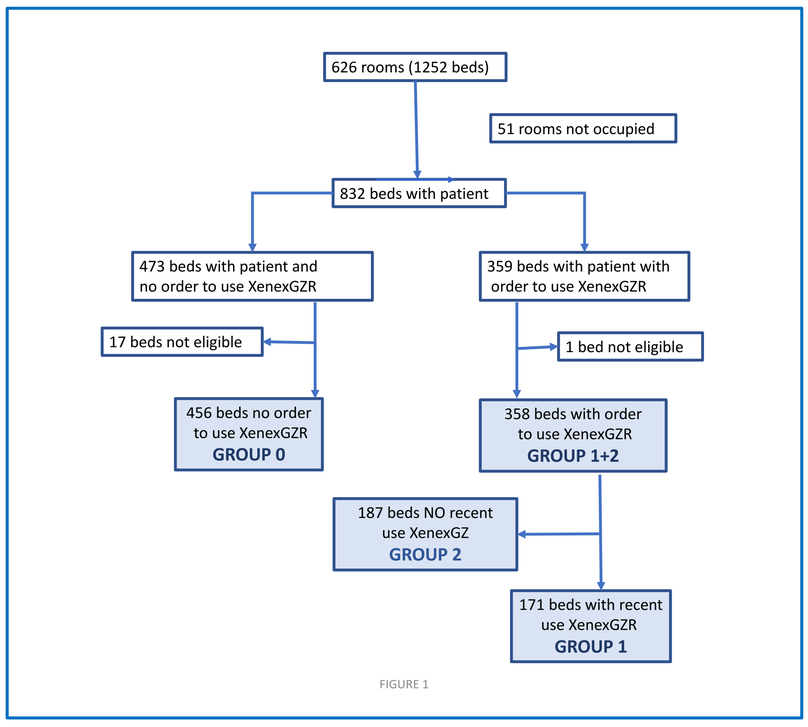

FIGURE 1

Results

For **groups 0, 1 and 2**, the mean volumetric sampling of aerobic microorganisms was 133, 125 and 156 CFU/m^3 respectively. In the comparative analysis, with respect to the microbial load of the air, there is a tendency to decrease it without significant differences both in the comparison **group 0 versus 1 + 2** as well as **0 versus 1** (p = 0.30 and p = 0.74).

For fungi (mean volumetric sample group 0= 4, group 1=3 group 2 =5), there is significant difference between group **0 and 1** (p = 0.03) but not between **groups 0 and 1 + 2** (p = 0.80)

The total number of MDRO isolates was n= 84: *Enterobacteriaceae* and *Pseudomonas* spp. No strain of other MDRO were isolated

CDIFF n= 4 (insufficient for statistical analysis).

The MDRO number for **groups 0, 1 and 2** was 61, 10 and 13, respectively.

Regarding the isolated MDRO, significant decrease was observed in both comparisons (p <0.001 in both cases, except for push buttons)

Because in our ICU there are numerous long-stay patients, a large number of whom are immunocompromised with a high number of lung transplant patients and in order to evaluate the results according to the days of admission, the classification of the parameters was created in relation to the median of total days of admission: 9; two groups were created for each bed/patient in the rooms: Of short stay, from 0 to 9 days, long stay more than 9 days.

The results of the statistical analysis for the MDRO in the immediate surroundings of the patient are shown in the tables: 1 bed rails and 2 medical device push buttons.

Figure 2: Tthe **XenexGerm-Zapping RobotsTM device (XenexGZR)** in one operating theatre at Vall d'Hebron University Hospital

BED RAILS								
Intention to use the XenexGZR			0 NO	1 YES	2 YES		0 VS 1+2	0 VS 1
Recent use XenexGZR (<7d)				No	YES	Total	MH P-VALUE	MH P-VALUE
	Duration of stay							
MDRO	short	NEGATIVE	212	66	126	404	0.0147	0.234
		POSITIVE	8	1	4	13		
	long	NEGATIVE	208	113	41	362		
		POSITIVE	27	5	2	34		
TOTAL						813		

TABLE 1

MEDICAL DEVICES PUSH BUTTON								
Intention to use the XenexGZR			0 NO	1 YES	2 YES		0 VS 1+2	0 VS 1
Recent use XenexGZR (<7d)				No	YES	Total	MH P-VALUE	MH P-VALUE
	Duration of stay							
MDRO	short	NEGATIVE	215	67	128	410	0.0268	0.1686
		POSITIVE	5	0	2	7		
	long	NEGATIVE	223	114	42	379		
		POSITIVE	12	2	0	14		
TOTAL						810		

TABLE 2

Discussion/Comments and Conclusions

The use of XenexGZR decreases the biological environmental burden. The studied area does not present environmental colonization by CDIFF

The environment should be considered an important factor in infection control, and resources should be directed towards improving disinfection, hand hygiene and AIH risk. In our opinion, the use of Xenex can help to reduce the transmission of MDRO from the environment to the patient

A decrease in the number of total MDRO isolates was observed with the use of XenexGZR. A priori, long-stay patients, in which we found more MDRO isolates, are candidates for HAI infections and would benefit most from the routine use of XenexGZR, so we recommend enhancing its use in this group.

Our work, unlike those that can be found in the literature, which take microbiological samples immediately after cleaning, collects them under usual conditions of use; this supposes a more real monitoring of the possible improvement related to the use of the robot to eliminate and / or decrease the transmission of microorganisms

We next want to study the reduction in the incidence of nosocomial infections in a general ICU when disinfecting them with the XenexGZR ; We will try to answer the question of how much the robot is able to protect against infection by MDRO

Because we have few samples in group 1 (recent use of the device) and the characteristics of our center, our next step should be to expand the study to include more individuals in that group

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