

**RAPID REMOTION OF SUSPENDED ASPERGILLUS SPP SPORES IN HOSPITAL  
ROOMS BY MEANS OF A NOVEL DEVICE (STERILITE®)**

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## **Summary**

**Aim:** to reduce the concentration of *Aspergillus* spp spores in a high-risk ward, by using a novel UV radiation decontamination device, Sterilite® (Ariane XL, AB medica, Italy).

**Material and Methods:** *Aspergillus* spp charge has been evaluated with SAS and contact Rodac plates before and 48 hours after Sterilite® activation in three rooms of a Hematological Ward in Genoa, Italy.

**Results:** in all samples, SAS and Rodac, *Aspergillus* charge dropped to zero, even where basal conditions were critical (1680 CFU/mc).

**Conclusion:** Sterilite® may represent a very efficient tool for the prevention of airborne infections and, in particular, of aspergillosis.

## **Introduction**

Aspergillus spores are ubiquitous fungi that commonly occur in soil decaying vegetation. They have been cultured from unfiltered air, ventilation system, contaminated dust dislodge during hospital renovation and construction, horizontal surfaces, food and ornamental plants (1,2).

A primary risk factor per Aspergillosis is a severe granulocytopenia, so it is particularly dangerous in highly immunocompromised subjects (patients undergoing chemotherapy and/or organ transplantation, including bone marrow transplantation for hematological and other malignant neoplasm (1, 3-5). In this patients Aspergillus nosocomial infection can cause heavy illness and death (6).

So it's very important to maintain an environment as free as possible of Aspergillus spores where these kinds of subjects are hospitalized. An Aspergillus air count of less than 5 colony forming units (CFU)/m<sup>3</sup> in protective isolation suites are recommended and count less than 0.1 CFU/ m<sup>3</sup> are desirable. Nevertheless the cause of micotic contamination cannot be rapidly found and removed (7).

The aim of the present study was to reduce the concentration of Aspergillus spp spores and, as a consequence, airborne Aspergillosis infections, in a high-risk Ward in Genoa, Italy, by using a novel UV-C radiation decontamination device, Sterilite® (Arienne XL, AB medica, Italy).

## **Material and Methods**

In March 2000 three rooms of a Hematology Ward of S. Martino Hospital (Genoa, Italy) were studied. The rooms had a mean cubage of XXX cubic meters and a mean of XXX inhabitants. During the studied period the hospital was under renovation, but all windows were kept closed during the studied period.

The studied device, Sterilite® (Ariane XL, AB medica, Italy) lowers the bacterial load of air by means of an innovative method that exploits the germicidal properties of UV-C rays: two silent fans convey air from the room through an optical labyrinth into the “irradiation chamber” inside the equipment. Here air undergoes intense germicidal radiation field emitted by six UV-C bulbs (55 Watts each for a total power of 330 W); after passing through a second optical labyrinth, the air is released back into the room. The air passes easily and silently through the optical labyrinths while germicidal radiation is totally confined inside the equipment. This solution treats air (up to 400 m<sup>3</sup>/hour) with powerful germicidal radiation with absolute safety and without any effect on viable human tissue. It may be used continuously, also when the room is occupied. The low airflow resistance allows the use of silent fans. Irradiation takes place in direct contact with the lamps, where it is at its maximum efficacy and is concentrated with special aluminum mirrors; one device was settled in each room.

A Surface Air System microbiological air sampler (PBI International, Milan, Italy) was used to evaluate the *Aspergillus* spp suspended charge. The air sample was aspirated through the instrument at a nominal rate of 180 liters per minute for a preselected period of 20 seconds giving a volume range of 60 liters. The airflow was directed towards the agar surface of a 50 mm diameter contact plate (8). Each of the three studied rooms was divided into two sampling areas: the entry and the end of the room, the instrument was settled at 1.5 meters of height, to shame human breathing zone of potentially affected personnel. The concentration of *Aspergillus* in contact surfaces was

evaluated by contact Rodac plates. The medium of the plates has been directly rubbed in the surfaces.

Tests were performed in triplicate, firstly in basal conditions and secondly 48 hours after the switching on of the Sterilite®. After sampling, all plates were incubated at 37°C for 24 hours.

ANOVA test was used to compare mean data. P-values  $\leq 0.05$  and  $\leq 0.01$  were considered as statistically and high statistically significant differences, respectively.

## Results

Table 1 shows *Aspergillus* spp colony counts by SAS in the studied rooms before and after Sterilite®'s activation. All the rooms had a high concentration of *Aspergillus*, both at the entry and at the end of the room. After using Sterilite® for 48 hours consecutively the *Aspergillus* charge significantly dropped to zero in all samples.

	Sterilite inactive		Sterilite switched on	
	Entry-room	End-room	Entry-room	End-room
	CFU/mc	CFU/mc	CFU/mc	CFU/mc
Room n°1	<b>1680</b>	<b>10</b>	<b>0</b>	<b>0</b>
Room n°2	<b>1680</b>	<b>1680</b>	<b>0</b>	<b>0</b>
Room n°3	<b>4</b>	<b>4</b>	<b>0</b>	<b>0</b>

Table 2 shows *Aspergillus* spp colony counts by contact Rodac plates in the same rooms before and after the Sterilite®'s action. All *Aspergillus* colony counts fall to zero after Sterilite®'s activation, but in the room B the difference didn't reach the statistical significance.

	Sterilite inactive		Sterilite switched on	
	Entry-room	End-room	Entry-room	End-room
	CFU/mc	CFU/mc	CFU/mc	CFU/mc
Room n°1	1680	0	0	0
Room n°2	1	0	0	0
Room n°3	11	10	0	0

## Discussion

The presence of *Aspergillus* spp in the hospital environment is the most extrinsic risk factor for opportunistic *Aspergillus* infections. Environmental disturbances, caused by construction and/or renovation activities in and around hospitals, markedly increase the airborne *Aspergillus* spore counts in such hospitals and have been associated with nosocomial aspergillosis (1,2). Aspergillosis in immunocompromised patients is also related to other hospital environmental reservoirs, such as contaminated fireproofing material, damp wood and bird dropping in the air ducts (1, 3-5).

Outbreaks of invasive aspergillosis in patients with severe granulocytopenia reinforce the importance of maintaining an environment as free as possible of *Aspergillus* spores in Hematology and in other high-risk wards. Special “protected environment” has been organized in many hospitals, to achieve this aim. Specialized personnel work in reducing the risk of exposition to *Aspergillus*, in controlling hospital air filtration and ventilation systems, especially during hospital construction and routine maintenance, when *Aspergillus* spp contamination can increase.

The oldest and most studied example of “protected environment” is a room with laminar airflow. It consists on a bank of HEPA filters along a whole lining of the room; air is pumped by blowers through these filters and into the room at a uniform velocity forcing the air to move in a laminar, or at least in unidirectional pattern. However, setting up a laminar airflow is very expensive and it needs frequent maintenance.

On the contrary the proposed new device Sterilite® (Ariane XL, AB medica, Italy) has shown to be a cheaper and valid system in reducing microorganisms' contamination. Previous studies underlined the usefulness of Sterilite® in preventing airborne infections in some Italian hospitals (9-10). The aim of our study was to evaluate if it would be useful also in the prevention of aspergillosis in a high-risk Hematology ward of Genoa's hospital.

Excellent results have been reached: in fact *Aspergillus* contamination dropped to zero in all samples, even where basal condition were critical (1680 CFU/ml), after 48 hours of Sterilite® activation.

It would be concluded that Sterilite® may represent a very efficient tool for the prevention of airborne infections and, in particular, of aspergillosis. This device presents all advantages of the high germicidal efficacy of UV-C radiation, without any of the known adverse effects. Moreover the optical labyrinth completely traps germicide radiation, so that high radiation levels may be used continuously without any side effect. Its quickly efficacy makes it very useful in emergency situations, during outbreaks of *Aspergillus* contamination or when laminar flow is inefficient. However we think that at the moment laminar flow should be considered firstly in the organization of “protected room” and Sterilite® should be settled for supporting it and activated when laminar flow is not available.

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