MOBILE LAMINAR AIRFLOW UNITS TO REDUCE AIRBORNE BACTERIAL CONTAMINATION IN THE OPERATING ROOM: EXPERIENCES FROM A SWEDISH NEUROSURGERY DEPARTMENT

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Introduction

Exogenous surgical site infections are caused by contamination of the surgical site during the actual operation. Contamination can be airborne or through contact with instruments or fluids, which may be contaminated during the operation.

The unit of measurement for airborne bacteria is colony-forming unit (CFU) per m^3. The microbiological quality in the operating room (OR) depends on numbers of staff, their clothing and level of activity, type of ventilation and door openings.

The majority of neurosurgical operations are classified as infection-prone clean surgeries since artificial implants are used, and thus require ultra clean air in the OR. A mean value of ≤5 CFU/m^3 in sampled air is used as a guideline to ensure ultra clean air.

Despite the fact that surgical site infections after neurosurgery could be devastating, there are no previous studies assessing air quality during neurosurgical operations.

The aim of the study was to assess the effect of mobile laminar airflow (MLAF) units on the microbiological air quality in ORs with conventional turbulent ventilation.

Figure 1. SteriStay MLAF unit

Figure 2. Operio MLAF unit

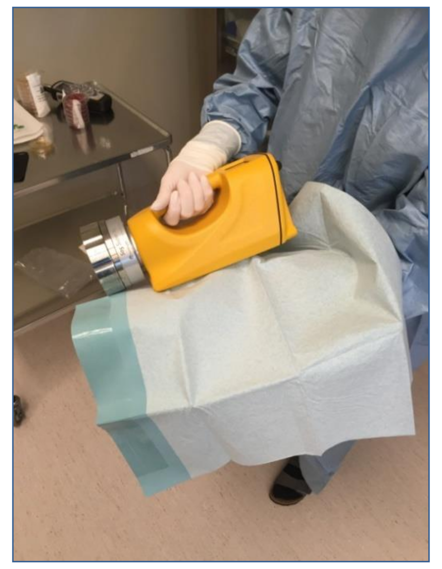

Figure 3. Draping of air sampler

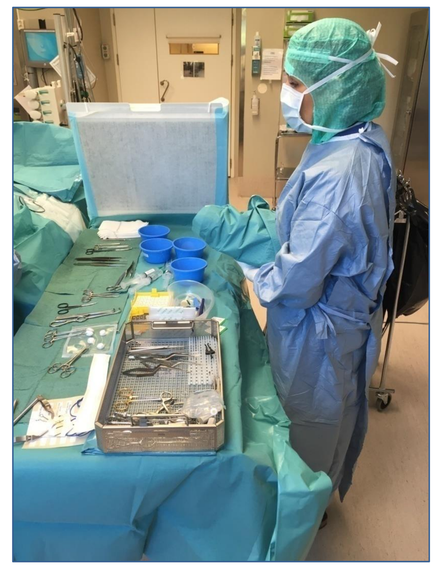

Figure 4. Air sampling during surgery

Figure 5. Incubation of agar plates

Methods

This study had a quasi-experimental design and was part of a larger project; Innovation Against Infection, coordinated by Research Institutes of Sweden (RISE).

Active air sampling was performed according to Swedish Standards Institute technical specification SIS-TS 39:2012, during neurosurgical operations; in ordinary conditions and using additional MLAF units.

The following MLAF units were used: SteriStay (**Figure 1**) protecting the instruments from airborne bacterial contamination, and Operio (**Figure 2**), directed towards the surgical site and protecting both instrument and the surgical site.

An air sampler was used to collect airborne microorganisms on agar plates. In each measurement, an agar plate was inserted in the air sampler and the sampler was draped (**Figure 3**).

Sampling was conducted peripheral in the OR, ≤0.5 m from the surgical site and above the instrument table (**Figure 4**). The agar plates were incubated before the bacterial count (**Figure 5**).

Data was collected monthly during 16 months.

Results

The data collection was concluded in June 2016. A total of 199 agar plates were sampled during 38 neurosurgical operations, 19 with conventional ventilation, and 19 using additional MLAF.

The data was not normally distributed, thus non-parametric statistical methods were used.

The results showed significant reduction of CFU/m^3 when using MLAF: in the surgical site (CFU range 1-13, median=2 in MLAF, and range 1-127, median=15 without MLAF, $p<0.001$), and above the instrument table (CFU range 1-13, median=0 in MLAF, and range 1-147, median=12 without MLAF, $p<0.001$).

Figure 6 show an incubated agar plate after sampling in MLAF, while **Figure 7** show an agar plate incubated during the same operation (brain tumor exstirpation) outside MLAF.

A regression analysis showed that only one variable significantly affected CFU/m^3: the use of MLAF. Numbers of staff or door openings were non-significant variables.

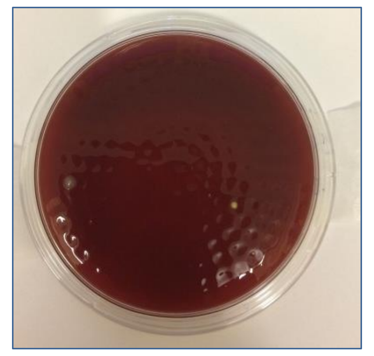

Figure 6. Agar plate, sampling in MLAF (2 CFU)

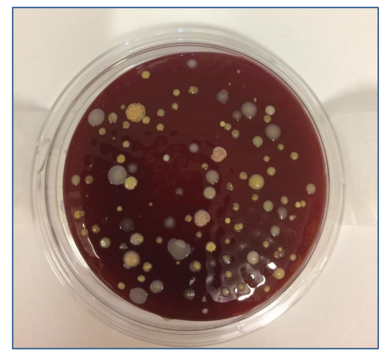

Figure 7. Agar plate, sampling outside MLAF (111 CFU)

Conclusion

The MLAF units significantly improve the microbiological air quality into ultra clean air levels in the sterile zone when used in conventional turbulent ventilation.

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