

# Reducing Infection Risks in Surgery By Means of Particle Tracing

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## Abstract

Patients undergoing surgery are very sensitive to infections. One of the main risks for implant related surgical site infections occurs when airborne bacteria carrying particles reach the surgical wound either directly or indirectly via the surgical instruments. The operation staff may spread  $10^4$  particles per person per minute, of which ten percent are presumed bacteria-carrying. Location and movements affect air-flow and hence particle dispersion in the room. This study has examined the Laminar Air Flow and conventional ventilation in an operating theater using COMSOL Multiphysics 4.2a where Navier-Stokes equation was solved for the airflow and this was introduced into Newton's equations for the particle trajectories. The geometry of the room, operating tables and larger objects used in the simulation were measured from two existing operating rooms in the hospital (Östra sjukhuset) in Gothenburg to be able to make a realistic simulation. Figure 1 (top view) and 2 (side view) show the results for the Laminar Air flow-ventilation. Particles from the surgeon (circle) do not enter the operating table (patient) and also do not land on the floor where they could be further contaminated. Grey areas are air outlets. Figure 3 (top view) and 4 (side view) show the results for the conventional ventilation in a case where staff is in front of the air inlet unit (light blue rectangle). There's turbulence and particles enter the patient area as well as touches the floor. The results of this study indicate that the Laminar Air flow-ventilation gives a much more controlled flow where fewer particles reach the surgical wound than with conventional ventilation where it is more likely that the staff unconsciously disrupt the flow. We also find that even for Laminar Air flow ventilation it takes more than two minutes for the particles in motion to leave the room. It could therefore be recommended to increase the "standard" 30 seconds to two minutes before "starting" the operation.

## Figures used in the abstract

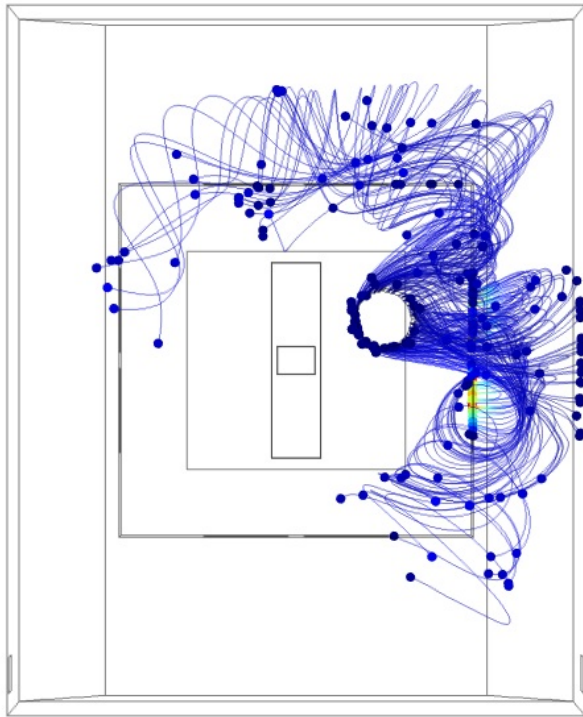


Figure 1

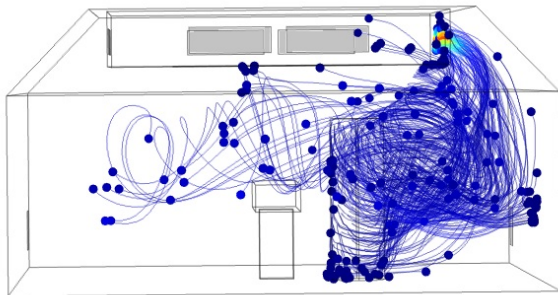
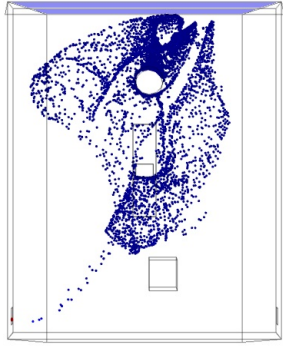
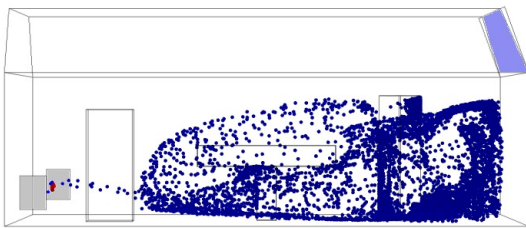


Figure 2



**Figure 3**



**Figure 4**