Hospital ventilation

Airflow and ventilation are particularly important in healthcare premises. To a hospital operating theatre, the air exchange has four main functions: to control the space temperature and humidity, to assist the removal of and dilute waste anaesthetic gases, to dilute airborne bacterial contamination, and to control air movement for minimizing the transfer of airborne bacteria. The key is to provide movement of clean conditioned air in the area where the operation is to be performed, and where the sterile instrument and drapes are exposed. This can be achieved by means of a down flow of air from an air filter bank or diffuser over the sterile field of the operation. For different countries, the infection control practices may not be exactly the same owing to the uniqueness in cultural background. Originally properly designed systems can be used wrongly to the extent that the intended functionality is reduced or even leading to increased risks. The ventilation systems in the older hospitals are very often not matching the up-to-date professional standards. The limitations are mostly the site constraint and the financial constraint. In case deviations from the standard are found, the application of CFD is useful to help understand the adequacy and appropriateness of the ventilation design.

Isometric view of an operating theatre model
Airflow patterns at vertical section cutting across mid-plane of operating table for 6 operating cases

(a) Case 1: reference condition

(b) Case 2: discharge velocity at 0.25 m/s

(c) Case 3: discharge velocity at 0.19 m/s

(d) Case 4: discharge velocity at 0.13 m/s

(e) Case 5: without partial wall

(f) Case 6: changed main medical lamp position
Related publications:


Chow TT, Kwan A, Lin Z, Bai W. *Conversion of operating theatre from positive to negative pressure environment*. Journal of Hospital Infection, 64(4), 2006, 731-738.