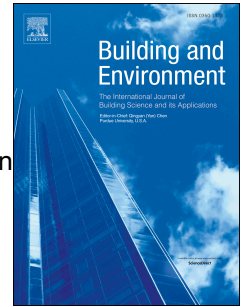


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Impact of surgical lights on the velocity distribution and airborne contamination level in an operating room with laminar airflow system

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Abstract

The presence of surgical lights disturbs the flow of ultraclean air in operating rooms (ORs) with vertical laminar airflow systems (LAF) by creating a wake downstream of the lights. The wake may be characterised by velocities low enough to directly influence the level of airborne microbe-carrying particles (MCP) close to the surgical site in an OR, eventually leading to surgical site infections (SSIs). The influence of surgical lights on airflow distribution during non-operating conditions and on airborne contamination level close to the operating table during mock surgeries was analysed in ORs with vertical LAF systems. The velocity and turbulence intensity (TI) distributions were recorded through a cross-sectional grid of points under surgical lights during non-operating conditions. In order to detect microbiological contamination during operating conditions, four mock surgeries were performed mimicking real surgeries on a porcine tissue. Three of the surgeries were performed under different types of surgical lights and one surgery did not include surgical lights at all. The mean velocity under all three surgical lights was significantly lower (≤ 0.07 m/s) compared with the mean velocity measured when the LAF was not obstructed by lights (0.24 m/s). At several points in the grid under all three lights, velocities as low as ≤ 0.02 m/s were measured. Air sampling during mock surgeries recorded at least 1 CFU/m³ for 43% of the samples (n=16; mean=1.25; range 0-4) using surgical lights, while not a single bacteria count was recorded without the use of lights (n=7).

Research Highlights

- We studied the effect of surgical lights on airflow disruption in an operating room
- The velocity distribution was analysed under differently shaped and sized lights
- Microbiologic. sampling was performed during mock surgeries with and without lights
- More bacteria counts were detected during surgeries performed under surgical lights
- The procedure without surgical lights did not record a single bacteria count

1. Introduction

Earlier studies have shown that bacterial concentration in operating rooms (ORs) with vertical laminar airflow (LAF) systems can be up to 20 times lower compared with ORs that are equipped without LAF systems [1], and many existing national standards prefer LAF systems to be installed in the ORs [2-7]. DIN 19464:2008-12 [2] specifies the most stringent rules to be applied for supply airflow parameters, requiring a minimum supply of air velocity of 0.23 m/s and a minimum area size of the diffuser to be 3.2×3.2 m² for an OR to rely on LAF ventilation. Although its role in contamination control in ORs has been questioned and disputed in recent years [8], several studies

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