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Title **Evaluation of Droplet Dispersion During Non-Invasive Ventilation, Oxygen Therapy, Nebulizer Treatment and Chest Physiotherapy in Clinical Practice: Implications for Management of Pandemic Influenza and Other Airborne Infections**

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Aim

To evaluate the characteristics of droplet/aerosol dispersion around delivery systems during noninvasive ventilation (NIV), oxygen therapy, nebulizer treatment, and chest physiotherapy by measuring droplet size, geographical distribution of droplets, and decay in droplets over time after the interventions were discontinued.

Conclusions and results

NIV using a vented mask produced droplets in the large size range (>10 µm) in patients (p=0.042) and coryzal subjects (p=0.044) compared with baseline values, but not in normal controls (p=0.379), However, this increase in large droplets was not seen using the NIV circuit modification. Chest physiotherapy produced droplets predominantly of >10 µm (p=0.003), which, as with NIV droplet count in the patients, had fallen significantly by 1 m. Oxygen therapy did not increase droplet count in any size range. Nebulized saline delivered droplets in the small- and medium-size aerosol/droplet range, but did not increase large-size droplet count. NIV and chest physiotherapy are droplet- (not aerosol-) generating procedures, producing droplets of >10 µm. Due to their large mass, most fall out onto local surfaces within 1 m. The only device producing an aerosol was the nebulizer, and the output profile is consistent with nebulizer characteristics rather than dissemination of large droplets from patients.

Recommendations

The findings suggest that healthcare workers providing NIV and chest physiotherapy, working within 1 m of an infected patient, should have a higher level of respiratory protection, but that infection control measures designed to limit aerosol spread, eg, negative-pressure rooms, may have less relevance. The results may have infection control implications for other airborne infections (eg, severe acute respiratory syndrome and tuberculosis) and for pandemic influenza infection.

Methods

Three groups were studied: 1) normal control subjects, 2) subjects with coryzal symptoms, and 3) adult patients with chronic lung disease who were admitted to hospital with an infective exacerbation. Each group received O2, NIV using a vented mask system and a modified circuit with nonvented mask and exhalation filter, and nebulized saline. The patient group had a period of standardized chest physiotherapy treatment. Droplet counts in mean diameter size ranging from 0.3 to >10 µm were measured with a counter placed adjacent to the face (D1) and at 1 m (D2) from subject/patient at the height of the nose/mouth of an average healthcare worker.

Further research/reviews required

See Executive Summary link www.hta.ac.uk/2225.

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