

Ignacio Martin-Loeches  
Antoni Torres

## Are preoperative oral care bundles needed to prevent postoperative pneumonia?

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I. Martin-Loeches  
Critical Care Centre, Corporación Sanitaria Universitaria Parc Tauli, Sabadell University Hospital, Universidad Autónoma de Barcelona, CIBER Enfermedades Respiratorias, Sabadell, Barcelona, Spain

A. Torres (✉)  
Servei de Pneumologia, Institut Clinic del Tòrax, Hospital Clinic, Barcelona, IDIBAPS, CIBER Enfermedades Respiratorias, University of Barcelona, Villarroel 170, 08036 Barcelona, Spain  
e-mail: ATORRES@clinic.ub.es

The lower airway is an area usually sterile in healthy people; the exception is limited to patients with chronic lung diseases. On the other hand, the human oral cavity contains a number of different habitats, including dental plaque (DP), teeth, gingival sulcus, tongue, cheeks, hard and soft palates, and tonsils, which are colonized by bacteria. The oral microbiome has been characterized by molecular methods such as 16S rRNA pyrosequencing and microarray assay. Oral microbiome is comprised of over 600 prevalent taxa at the species level, with distinct subsets predominating at different habitats [1]. Poor dental hygiene has been associated with an increased rate of hospital-acquired pneumonia (HAP); however, the definitive link between dental and oral colonization and lower respiratory tract infection has been confirmed by the isolation of respiratory pathogens in patients with HAP, which were matched genetically by pulsed-field gel

electrophoresis with those recovered from the corresponding DPs [2].

Prognosis factors of ventilator-associated pneumonia (VAP) have been largely investigated, while the data concerning postoperative pneumonia (PP) are scarce. Therefore, the greatest attack rates appear to be during the initial days of mechanical ventilation and are associated with a higher mortality [3]. In the same line, patients who undergo major surgery can develop PP. It is unclear whether this phenomenon is a consequence of an established disease process or precedes the infective process. There are several factors which may or may not be preventable. Whilst some non-modifiable factors that are present are related to the host, and therefore the immune response may be important in generating an initial predisposition for the occurrence and subsequent outcome of infection [4], some other factors can be modified by medical intervention [5]. Bronchial bacterial colonization has been widely investigated in patients with chronic lung disease and, following this hypothesis, Ioanas et al. [6] performed bilateral protected specimen brush and lung tissue biopsy during surgical procedures on patients with resectable lung cancer and found that almost half of them presented with bronchial colonization with at least one potential pathogenic micro-organism. Based on this strategy, Bouza et al. [7] performed a prospective randomized open-label study of major heart surgery (MHS) patients requiring MV for >48 h with the use of pre-emptive broad-spectrum treatment, and this strategy did not reduce the incidence of VAP but increased the rate of resistant pathogens.

During the process of mechanical ventilation, endotracheal intubation breaks the isolation of the lower airway, and micro-aspiration might play a major role in the pathogenesis of PP. If oropharyngeal secretions are colonized, this is a potential source of PP. Consequently, a second strategy for prevention could be oral care to

reduce the bacterial burden of oropharyngeal secretions. In order to prevent PP, Akutsu et al. [8] performed a prospective cohort study in thoracic esophageal cancer patients who underwent an esophagectomy. The patients were divided into a consecutive series of 2 groups based on the time of the patients' admission, and found that preoperative dental brushing decreased the rate of PP by almost 5 times (32 % vs. 9 %,  $p = 0.013$ ), while when only patients with pathogenic bacteria in their dental plaque were studied (71 vs. 17 %), the reduction was as impressive, as it was by more than 12 %. In the present issue of *Intensive Care Medicine*, Bergan et al. [9] conducted a study that, with the help of a dentistry unit, patients were taught how to improve oral care before MHS. The authors found that patients with satisfactory oral hygiene had 12 times less chance to develop PP compared to those without it. One of the recurrent problems of oral hygiene recommendations is based on the heterogeneity of the published studies. Some important features, such as oral care in edentulous patients, requirement of tongue brushing, different concentrations of chlorhexidine solutions, and the frequency and

duration of oral hygiene, have been studied independently and so extracting conclusions is difficult [10]. However, Bergan et al. elegantly assessed preoperative mouth conditions by the use of four indices of global mouth assessment. Based on this scoring, an oral health protocol was implemented that included not only the dental plaque but the whole mouth. It is also not surprising that patients with a lower monthly income had a higher risk of PP that might result in fewer healthcare resources. Whilst the strategy proposed is easy to put into practice, it is important to mention that the results come from a single arm non-randomized prospective intervention study that started with very high rates of PP (32 per 1,000 ventilator-days). It is also acknowledged by the authors that the mean VAP rates were decreasing even after the intervention period and therefore a selection bias based on a Hawthorne effect cannot be excluded.

In summary, in order to decrease PP, an oral health protocol seems to be mandatory based on a preoperative assessment of the entire mouth. Strategies of oral care bundles should be global in order to define that the whole is greater than the sum of its parts.

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