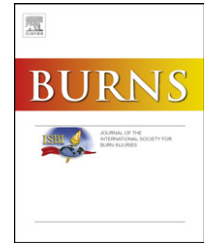


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Letter to the Editor

Chest physiotherapy using intrapulmonary percussive ventilation to treat persistent atelectasis in hypoxic patients after smoke inhalation

Dear Sir/Madam,

Patients have difficulty in mobilizing their respiratory secretions after smoke inhalation injury related to disturbances in mucociliary clearance mechanisms and exposure to smoke components. The prolonged bed stay and overall muscle weakness and wasting, with increased amounts of bronchial secretions secondary to smoke exposition, lead to an increased risk of developing both lung atelectasis and pneumonia [1]. This may result in hypoxemia and acute respiratory failure. Atelectasis may be prevented by chest physiotherapy but when installed, have to be treated aggressively.

In this retrospective observational study, we described the utility of intrapulmonary percussive ventilation (IPV) to treat persistent pulmonary atelectasis associated with hypoxemia after smoke exposure. This particular chest physiotherapy using high frequency mechanical percussions at a positive pressure level between 6 and 12 cmH₂O was administered to spontaneously breathing patients through a face mask or mouth piece.

Physiotherapy using this device (TXP, Percussionnaire Corporation, ID, USA) may be useful for critically burn patients.

Ten patients with smoke inhalation history confirmed by fiberoptic bronchoscopy were admitted in the ICU (Table 1) and received manual repositioning every 2 h and conventional therapy with inhaled bronchodilators and suctioning. No major burns were present in this population (TBSA < 10%).

A few hours after admission these spontaneously breathing patients developed respiratory distress, associated with persistent segmental, lobar, or unilateral entire lung atelectasis. After repeated fiberoptic bronchial aspiration pulmonary atelectasis remained unchanged; the patients developed significant hypoxemia and were considered for the use of IPV as an alternative treatment.

IPV administered 30 min every 2 h with conventional physiotherapy resulted in complete and definitive resolution of atelectasis as compared with conventional therapy even after repeated fiberoptic examination. No patient failed to improve;

Table 1 – Patients baseline characteristics (TBSA total burn surface area) and differences in arterial blood gases before and during the IPV treatment period (PaO₂ partial artery oxygen pressure, PaCO₂ partial artery carbon dioxide pressure, FiO₂ fractional inspired oxygen concentration, $p < 0.05$ – SPSS stat software).

Baseline characteristics (n = 10)				
Sex: M/F				8/2
Age (years)				41 ± 8
TBSA on admission (%)				8 ± 1.8
Smoke inhalation criteria and smoker antecedent				
Tobacco smoker				8
Close space fire				9
HbCO more than 10%				9
Soot on facial orifices				9
Facial burns				7
Differences in arterial blood gasses		Mean difference	95% CI	p
PaO ₂ (mm Hg)		5.92	–5.88 to 14.56	NS
PaCO ₂ (mm Hg)		–6.49	–14.71 to 4.65	NS
PaO ₂ /FiO ₂		37.62	–18.56 to 59.5	0.038
pH		0.015	–0.010 to 0.012	NS

the median duration to complete resolution of atelectasis was 36.4 ± 12.6 h after starting IPV. There was a generalized trend toward statistical significance in the improvement of oxygenation after failure of bronchoscopy (change in baseline $\text{PaO}_2/\text{FiO}_2$ from 205.4 ± 56.7 mm Hg to 291 ± 70.7 mm Hg at the end of the therapy, differences in Table 1).

We used IPV to promote the mechanical clearing of the peripheral bronchial tree, creating the global effect of internal percussion of the lungs [2]. The major effect induced by percussive ventilation was the significant improvement in the patients' oxygenation ($\text{PaO}_2/\text{FiO}_2$ ratio) which is highly correlated with a lesser degree of early and late complications [3]. Percussive ventilation has been shown to increase the weight of tracheal secretions in hypersecretive patients [4,5]. In our study the effect of mucus removal might have been assessed by quantifying the amount of secretions. A standardized method to quantify the collected sputum does not exist and this measurement was not considered in this study where all cultures were negative.

In conclusion, intrapulmonary percussive ventilation is a feasible technique able to enhance chest physiotherapy in spontaneously breathing patients after smoke inhalation injury to resolve persistent pulmonary atelectasis. This is the first report on the use of IPV for the definitive treatment of persistent pulmonary atelectasis in this indication. Controlled studies are required to investigate if the use of systematic IPV will lead to fewer complications in burn patients with smoke injury and if spontaneous resolution of persistent atelectasis can be excluded.

Conflict of interest statement

The authors declare that there is no financial or scientific conflict of interest.

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