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Effects of Oral Endotracheal Intubation on Metabolic Gas Exchange

(Short communication)

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Endotracheal intubation performed in the beginning of general anaesthesia is a stress-inducing procedure associated with raised levels of circulating catecholamines and a rise in heart rate and blood pressure, as well as changes in other hemodynamic variables (2,4). Despite this, few studies have been devoted to evaluating the effects of this procedure on oxygen consumption (VO_2) (1). Today monitors for continuously measuring metabolic gas exchange are available (3) which provide a way to evaluate the effects of endotracheal intubation on VO_2 .

Twenty patients subjected to various types of common scheduled surgical procedures, such as hysterectomy, knee or hip artroplasty, inguinal hernia, tympanoplasty and mammaroplasty, were studied. Mean age was 65±17 years and 37 % were females. All patients were free from known cardiovascular or metabolic diseases and were not on regular medication known to interfere with the cardiovascular system or metabolism.

All patients were premedicated with 0.1 mg/kg diazepam orally and 1 mg/kg pethidin i.m.. Five min prior to administering the induction dose an intravenous injection of 2 μg/kg fentanyl was given. Sleep was induced by an infusion of 2 mg/kg propofol administered by a syringe pump over 30 seconds. As soon as the patient had lost consciousness vercuronium, at a dose of 0.1 kg/kg, was given for muscle relaxation, and a continuous infusion of propofol was

started at a rate of 10 mg/kg/h during the first 10 min. The infusion rate was thereafter decreased to 8 mg/kg/h over the next 10 min after which a maintenance dose of 6 mg/kg/h was given for the rest of the study. Neither nitrous oxide nor volatile agents were administered.

Metabolic gas exchange was measured using the commercial indirect colorimetry device Deltatrac (Datex Instr Corp, Helsinki, Finland), being validated in a study using butane combustion (3). Mechanical normoventilation with an inspired concentration of oxygen (F_IO_2) of 0.3 was initiated as soon as the patients were orally intubated. The measurements of metabolic gas exchange were begun at the same moment and were continually measured at minute intervals during the first 30 min of anaesthesia. During that time no surgery was performed. Heart rate and blood pressure were recorded every second min.

For the first 3 min after intubation and the start of mechanical ventilation, F_IO_2-expired concentration of oxygen (F_EO_2) showed negative values, mainly owing to a high F_EO_2 induced by the previously inhaled pure oxygen. Four min after ventilation was started VO_2 levels were approximately as high as those found later. From the 5th to 30th min of mechanical ventilation VO_2 changed according to a pattern, that significantly fitted a polynomial regression curve of the 3rd order ($r=0.76$, $p<0.04$, $y=3.9x-0.23x^2+0.004x^3+143$) with a maximum (175 ± 47 ml/min) at the 10th to the 13th min after intubation. A steady-state plateau (164 ± 37 ml/min) for VO_2 was reached 20 min after intubation.

Both blood pressure and heart rate showed temporal patterns similar to that of VO_2. The peak for blood pressure (119 ± 21 mmHg for systolic pressure) and heart rate (88 ± 13 beats per min) occurred after 4 min and thereafter declined (by 22 % for blood pressure and by 11 % for heart rate) to a steady-state level, reached after 15 min. The maximal VO_2 was not significantly related to the peak in blood pressure or heart rate.

Thus, the present study showed endotracheal intubation to induce an increase in VO_2 by 7%, when compared with the steady state-level achieved 20 min after intubation. This effect of endotracheal intubation was similar, but smaller than

in a previous study (1). Differences in anaesthetic procedure, route of intubation and the measurement techniques used might all have contributed to this difference in magnitude. The effects of intubation on blood pressure and heart rate were similar to those previously reported during anaesthesia with propofol and fentanyl (2). It is obvious that the cardio-vascular response to endotracheal intubation occurs earlier and is stronger than that of VO_2. Nevertheless, continuous measurements of metabolic gas exchange provide interesting data that can be used to evaluate the metabolic response to various stress-inducing treatments or procedures, such as endotracheal intubation.

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