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LETTER

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Effects of noninvasive ventilation on heart rate variability after coronary bypass grafting: comparison between ventilators

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Dear Editor,

Postoperative complications of coronary artery bypass grafting (CABG) are related to the amendment of pulmonary and autonomic function. Noninvasive ventilation (NIV) is indicated to reduce the risk of such complications and promotes beneficial effects on lung function, as in autonomic modulation [1]. NIV can be performed with a conventional ventilator (CV) or a specific ventilator (SV), designed specifically for application of NIV. The difference between the equipment is basically the system that is able to compensate the leakage. There are no studies demonstrating induced responses on autonomic modulation and hemodynamic changes by NIV in postoperative CABG patients using different equipment. Therefore, ten postoperative CABG patients underwent the NIV procedure with two different ventilators, CV (DX 3012®, Dixtal) and SV (BiPAP Vision®, Respironics), for 30 min each in this sequential, crossover study. Block randomization was used to determine the first technique to be applied; thereafter, the other procedure was performed. The positive expiratory pressure was set at 8 cmH_2O, the fraction of inspired oxygen was adjusted to maintain oxygen saturation (SpO_2) above 90 %, and the support pressure or inspiratory final pressure was adjusted to maintain a tidal volume (TV) of 8 mL/kg. The heart rate variability (HRV), systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were evaluated during 15 min before starting the procedures, 30 min during application of NIV with each ventilator, and 15 min after the procedures. Data collection started 4 h after extubation, and the patient was not under anesthetic effects. The HRV was analyzed using the time domain and frequency domain.

The patients showed a mean and standard deviation of extracorporeal circulation and mechanical ventilation time of 65 min (±10 min) and 12 h (±3 h), respectively. On the performance of NIV with the SV there was an increase in the high frequency (HF) index and DBP (Table 1). However, in NIV with the CV there was an increase in HR and SBP. There was no difference between the HRV indexes recorded before and after NIV, and also no significant correlation between

Table 1 Comparison of the response of the hemodynamic and autonomic variables, before, during, and after the use of the conventional ventilator (CV) and specific ventilator (SV)

Variables	Pre NIV (15 min) Median (min–max)	NIV with CS (30 min) Median (min–max)	NIV with SV (30 min) Median (min–max)	Post NIV (15 min) Median (min–max)	Comparison pre and post *p* value	Comparison between ventilators *p* value
HDM						
SBP (mmHg)	120 (98–164)	131.25 (100–189)	125.5 (83–182)	119 (101–168)	0.2367	0.0003*
DBP (mmHg)	64.5 (45–77)	61 (47–89)	64 (59–93)	64 (47–93)	0.456	0.1080*
HR (bpm)	95.5 (69–124)	90.5 (64–117)	88.25 (65–120)	94.5 (68–113)	0.493	0.0228*
Autonomic						
RR mean	554.7 (512–859.8)	567.2 (506.5–876.7)	608 (413–790)	549.9 (523.2–892.7)	0.3564	0.4565
SDNN (ms)	29.75 (12.2–38.3)	27.85 (10–43.8)	29.15 (13.4–50.4)	26.05 (4.9–43.4)	0.5641	0.6165
rMSSD (ms)	2.85 (1.2–20.4)	3.9 (2.1–10.1)	4.85 (1.5–12.4)	2.25 (1–16.7)	0.6123	0.1851
pNN50 (%)	0.25 (0–9.4)	0 (0–3.82)	0 (0–2.4)	0 (0–1.7)	0.6501	0.7532
NN50 (ms)	2.5 (1–2.0)	0 (0–1.7)	0 (0–1.4)	1 (0–2.5)	0.1331	0.4652
HF (nu)	34.8 (11.9–58.9)	19.1 (11.9–38.1)	39.3 (11.9–42.2)	33.15 (21.3–48.5)	0.5674	0.0469*
LF (nu)	64.05 (36.5–88.1)	62.85 (54–85.9)	60.7 (53–88.1)	66.85 (51.5–78.7)	0.2342	0.2026
LF/HF	2.103 (0.706–6.079)	3.444 (0.635–7.405)	2.93 (1.34–5.1)	2.529 (1.074–3.689)	0.2231	0.5754

The Pre NIV period (last 15 min before starting the NIV procedures), NIV with conventional and specific ventilator (30 min each equipment) and Post NIV (15 min after carrying out NIV procedures)

HDM hemodynamics, *SBP* systolic blood pressure, *DBP* diastolic blood pressure, *mmHg* millimeters of mercury, *HR* heart rate, *bpm* beats per minute, *RR mean* mean of RR intervals, *SDNN* standard deviation of all normal RR intervals recorded in a time interval, *pNN50* percentage of adjacent RR intervals whose difference lasts greater than 50 ms, *NN50* the number of adjacent NN intervals whose difference exceeds 50 ms, *HF* high frequency components, *LF* low frequency component, *LF/HF* ratio of low frequency component to high frequency component

* Statistical significance

hemodynamic variables and HRV indexes.

These results support the idea that NIV influences the cardiac autonomic behavior, since it led to an increased HF index during the execution of NIV with the SV. The HF index is a component of HRV that is intimately linked with parasympathetic predominance [2, 3]. And this may be related to the compensation system for leaks [4, 5]. Also, the SV produced an increase in DBP. On the other hand, the CV increased HR and SBP. During NIV, hemodynamic changes occur because of the change in intrathoracic pressure, reflecting the lower stroke volume. Maintaining the homeostasis of the autonomic nervous system performs adjustments, reproducing physiological responses in intervals of heartbeats influencing the autonomic control of HR [1, 2].

These findings could be important to clinical practice, since the NIV with SV could have a protective effect on the population.

Conflicts of interest There is no conflict of interest.

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