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Haemodynamic Effects of Non-invasive Positive Pressure Ventilation Assessed by Transthoracic Echocardiogram in Obstructive Sleep Apnoea Patients

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Introduction

Continuous positive pressure ventilation (CPAP) has wide clinical use. The haemodynamic effect by CPAP heart-lung interaction was not well reported.

Objectives

To study the CPAP haemodynamic effect to allow its safe clinical application and better interpretation of Echo parameters in patients put on CPAP.

Methodology

107 patients with obstructive sleep apnoea (OSA) put on CPAP followed up in Alice Ho Miu Ling Nethersole Hospital were recruited as subjects between April 2016 and September 2016. Transthoracic echocardiograms were performed twice on each subject, once with and once without their CPAP machines on, and the paired echocardiogram parameters were compared in terms of left ventricular systolic function, left ventricular diastolic function, right heart systolic function, right heart pressure effect and heart dimensions.

Result

There were statistical significant and echocardiogram measureable reductions, after application of CPAP, in the heart dimensions, LV systolic function and the RV systolic function. The reductions were largely compatible with physiological prediction, but were all small clinically to reassure the safety of CPAP application, in relatively normal subjects.

The drop in left ventricular (LV) diastolic volume with CPAP by 4.15 ± 12.51 ml, $p = 0.001$, and the drop in left ventricular systolic function might mean that the decrease in LV preload might be predominant over change in LV afterload, LV compliance and also the effect of ventricular interdependence.

There was significant change in parameters reflecting the right heart pressure. With application of CPAP, there was significant increase in the diameter of the inferior vena cava (IVC), and there was a significant decrease in IVC variability from 44.56 +/- 14.86 % to 36.12 +/- 11.42%. This implied that the prediction of right atrial pressure by these IVC parameters was not accurate in subjects put on CPAP.

The maximum velocity of tricuspid regurgitation (TRVMax) also decreased significantly from 180.66 +/- 6.95 cm/sec to 142.30 +/- 52.73 cm/sec with the application of CPAP, and so caution was needed in estimating the trans-tricuspid pressure gradient by Bernoulli's equation in patients put on CPAP. Alternative methods, including right heart catheterization, to estimate right heart pressure in patients on CPAP would thus be recommended.

There was no statistical significant change in the left ventricular diastolic function with the application of CPAP.