77 - PERFORMANCE OF PULMONARY FUNCTION IN PATIENTS SUBMITTED TO CARDIAC SURGERY

JAQUELINE BRIÃO CARDOSO
RICARDO GASS
ÉBONI MARÍLIA REUTER
DANNUEY MACHADO CARDOSO
DULCIANE NUNES PAIVA
Universidade de Santa Cruz do Sul, Santa Cruz do Sul, Rio Grande do Sul, Brazil
dulciane@unisc.br

1 INTRODUCTION

There are reports saying that nowadays about 275,000 cardiac surgeries are performed in the world, and the operative mortality ranges from 1 to 15%. In Brazil, this procedure is becoming more frequent and its practice has been increasing steadily since it is responsible for the reduction of symptoms as well as optimizing survival and quality of life of cardiac patients (GUARAGNA et al., 2010).

Despite technological advances, pulmonary complications (CPs) are an important cause of morbidity and mortality in the postoperative (PO), in addition to increasing the length and costs of hospitalization for the health system. Such Pulmonary Complications can be triggered by pathophysiological changes during anesthesia or cardiopulmonary bypass (CPB) for phrenic nerve injury or by surgical incision that causes pain and limits the action of the respiratory muscles. All these associated factors contribute to the emergence of changes in pulmonary function in the postoperative period (CHIUMELLO; CHEVALLARDS; GREGORETTI, 2011).

Studies on pulmonary function after cardiac surgeries show that lung volumes are not recovered to preoperative values up to eight weeks postoperatively. The lung function remains at 25 to 30% less even after 3.5 months of surgery (Ferreira et al. 2010).

Due to the knowledge of these possible postoperative complications, there is a need to measure the functionality in preoperatively and postoperatively, to understand the dynamics of the therapeutic process and intervene when necessary. For this purpose it is necessary to evaluate the consequences of of surgery on lung function by spirometry. This test allows measuring the lung volume and capacity in a dynamic way, with good accuracy and reproducibility (GONTIJO et al., 2011).

Given the context of pulmonary dysfunction associated with cardiac surgery and its possible repercussions, noninvasive ventilation (NIV) has been shown to be an alternative to improve alveolar ventilation and gas exchange, reducing the work of breathing and increasing lung volumes.

Based on evidence of pulmonary complications related to cardiac surgery and its consequent changes in lung function, the present study aimed to evaluate the performance of the pulmonary function in postoperative cardiac surgery for myocardial revascularization in patients undergoing CPAP Therapy and Conventional Phisiotherapy.

2 METHODS

This is a study of a quantitative nature and of pre-trial character that evaluated patients admitted to the Hospital Santa Cruz (HSC), the Unified Health System (SUS) for cardiac surgery CABG or valve replacement. There were evaluated adults of both genders aged 18 to 80 years.

The sample studied was non-probabilistic and of convenience consisted of eight (08) patients undergoing cardiac surgery. There were eligible patients those clinically stable, who underwent median sternotomy, use of CPB in intraoperative and who signed the Informed Consent Form (ICF). Exclusion criteria were hemodynamic instability, neurologic sequelae associated or difficulty in understanding and / or adherence to the procedures of the study. Still, there were excluded those with unstable angina, congestive heart failure (CHF) decompensated or with any co-morbidity that interfere with the study outcome. Exclusion criteria were hemodynamic instability, neurologic sequelae associated or difficulty in understanding and / or adherence to the procedures of the study. Still, there were excluded those with unstable angina, congestive heart failure (CHF) decompensated or with any co-morbidity that interfere with the study outcome.

2.1 Preoperative Evaluation

In the preoperative period, anamnesis and physical examins of patients were performed and relevant data was recorded such as medical history, information about the surgical process and the level of pain obtained by Visual Analogue Scale (VAS). The lung volumes were assessed by spirometry (EasyOne Spirometer ®, São Paulo, Brazil, Br).

There were measured vital signs (systolic-SBP, diastolic blood pressure - DBP, the oxygen saturation - SpO2, heart rate - HR respiratory rate - RR and axillary temperature - Tax).

Patients received guidelines on NIV and CPAP ventilation mode, which was held a brief application for the purpose of familiarizing patients with the equipment and to facilitate their adaptation to the mask, aiming a better adherence to treatment in PO.

2.2 Assessment of Lung Volumes

The lung volumes were assessed by spirometric test, measuring the forced vital capacity (FVC), forced expiratory volume in the first second (FEV1), peak expiratory flow (PEF) and the Index Tiffeneau (FEV1/FVC) and the forced expiratory flow at 25-75% of FVC (FEF25-75) in accordance with the standards of the American Thoracic Society (Miller et al. 2005). Such variables were compared with normal values established by Pereira et al. (1992).

The spirometric test was applied preoperatively with patients in sitting position, and they were instructed to expire to residual volume (RV) and after, to inspire to total lung capacity (TLC) in nasal occlusion, and the patient was instructed to perform the Forced Vital Capacity maneuver. This test was applied again in the post-operative period and immediately before discharge (pre-time high), in which all measurements were performed by the same examiner with the same blinded to the study objectives, and thereby ensured the reproducibility of the test.

2.3 Application of Continuous Positive Pressure

On day 1 postoperatively, after reached clinical stability and after extubation and the patient being lucid, it was carried out a new physical examination and evaluated lung volumes for as a result be instituted CPAP with pressures between 8 and 15 cmH2O. The pressure level was increased gradually, respecting the limit of tolerance of each patient. The application of NPPV occurred over a period of 15 to 20 minutes being applied twice a day, through non-invasive ventilator BiPAP (STD-30, Respironics

Vision ®) in the spontaneous mode.

The application of CPAP occurred throughout the postoperative period until the time of hospital discharge. Prior to discharge, the patient was again subjected to spirometric evaluation in order to prove the effect of NIV and chest physical therapy on lung function.

2.4 Statistical Analysis

The analysis consisted of descriptive and analytical statistics performed using SPSS software (version 20.0), and the results were presented by frequency, percentage, mean and standard deviation. To compare means, it was used the One Way ANOVA test being considered for significance levels p-value <0.05.

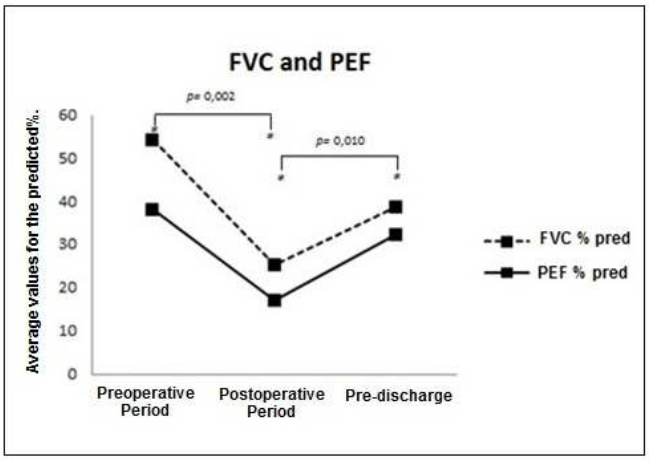
3 RESULTS

Of the eight (08) patients, three (37.5%) were female and five (62.5%) were male, mean age 47.5 ± 17.44 years old. Regarding BMI, the average was 27.73 ± 4.84 kg / m², in which subjects were classified mainly overweight, among these 02 overweight and 03 obese type I, and others classified as normal weight. The total hospitalization time of the study sample had a mean of 6.75 days.

The assessed lung volumes showed significant decrease when compared to those of postoperative to preoperative levels. In addition, there was significant improvement in FVC, PEF, FEV1/FVC and FEF25-75 when compared to the pre-to post-operative high.

Figure 1 shows the results expressed in mean for the percentage of predicted FVC and PEF obtained from the pre-operative PO and pre-high (FVC: 54.38%, 25.38% and 38.75%. PEF: 38.13%, 17.13% and 32.38%, both for the respective periods), being observed that there were significant decrease in both variables when compared the values obtained in the PO with the values of the pre-operative. At the same time, there was a significant increase when compared to the values in the PO values of the pre-high FVC and PEF (p = 0.002 and p = 0.010).

Figure 1.representative distribution of the changes in FVC and PEF in the preoperative, PO, and before hospital discharge.

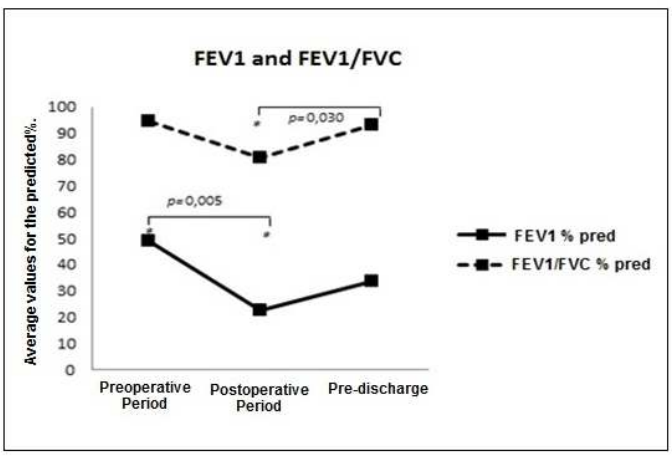


Source: researcher, 2012.

Figure 2 shows the performance of the values of FEV1 expressed in mean referring to the percentage of predicted, that in the preoperative phase was 48.88%, 22.63% in the PO and in the situation of pre-high 33.88% . The figure also exhibits the values of FEV1/FVC in mean percentage of predicted. Preoperatively was 94.63%, the PO was 80.63% and the pre-high was 93.13%.

In the preoperative period it was 94.63%, in the PO it was 80.63% and in the pre-high it was 93.13%. We can observed that there was a significant drop when compared to FEV1 values in the PO to preoperative values (p = 0.005). However, no significant difference was observed when compared the values of the PO to pre-high values, unlike the values of FEV1/FVC, in which there was a significant increase when compared the values obtained from the pre-high with values of PO (p = 0,030).

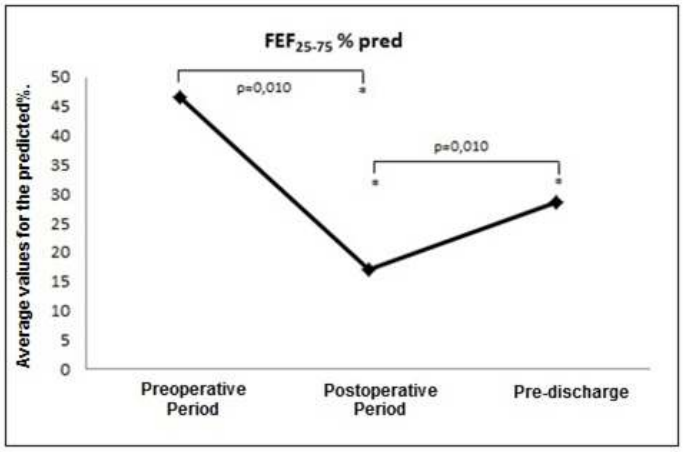
Figure 2.Representative distribution of the changes of FEV1 and FEV1/FVC in the preoperative, PO, and before hospital discharge.



Source: researcher, 2012.

The performance of FEF25-75 is illustrated in Figure 3. In the preoperative phases, the mean percentage of predicted was 46.63%, in the PO it was 17.00% and in the pre-high values was 28.63%, with a significant decrease in the PO of the values of FEV1 when compared to preoperative values (p = 0.010). Furthermore, it was observed a significant increase when compared the values obtained in the pre-high with values of PO (p = 0.010).

Figure 3.Representative distribution of the changes in FEF25-75 in the preoperative, PO, and before hospital discharge.



Source: researcher, 2012

4 DISCUSSION

Patients undergoing cardiac surgery often develop a framework of pulmonary dysfunction postoperatively, showing a significant reduction in lung volumes, impaired respiratory function, decreased lung compliance and increased work of breathing. The reduction in lung volumes contributes to changes in gas exchange, resulting in hypoxemia and decrease in diffusion capacity (RENAULT; COSTA; ROSSETTI, 2008).

The evidence-based physical therapy is increasingly used in the postoperative period of cardiac surgery for the treatment of CPs, especially in an attempt to accelerate the process of recovery of lung function that normally occurs only 15 days after the surgical procedure (FERREIRA; MARINO , CAVENHAGUI, 2012; MIRANDA; PADULLA; BORTOLATTO, 2011).

The results obtained in this study confirm this data and meet the current literature, whereas a significant decrease was observed in all spirometric variables analyzed when compared to the values obtained in the PO to the preoperative values. These findings were found in other studies of lung function after cardiac surgery, showing that pulmonary function remains from 25% to 30% lower even 3.5 months after surgery (FERREIRA et al., 2010) and lung volumes are not recovered to preoperative values up to 8 weeks after surgery.

It is noticeable the frequency of weight change in the subjects of this study, and IT must be considered, for according Fantinati and Oliveira (2011), obesity results in higher risk of decreased lung compliance, leading to limited lung capacity and volumes, causing changes in trade gas, increasing the chances of emergence of atelectasis and respiratory infections.

The presentation of pulmonary dysfunction is evidenced in many studies, and it is characterized by reduced lung volumes and shallow breathing; may or may not progress to pulmonary complications (SILVEIRA et al., 2011). Dysfunction may be due to factors related to preoperative status of the patient such as age, obesity and smoking. In the postoperative it is noteworthy a decreased stability and chest wall compliance by median sternotomy, the long periods in the supine position, the presence of pain and drains that imply, directly in maintaining low lung volumes (SILVEIRA et al. 2011; SOARES et al., 2011).

Soares et al. (2011) mentions other intraoperative factors that may interfere and justify the impairment of pulmonary function, including the use of CPB, the degree of sedation, the intensity of the surgery, and the number of pleural drains. These factors are pointed as the main responsible for changing respiratory mechanics in the PO.

The presentation of pulmonary dysfunction indicated by the literature was evidenced in this study, based on findings that confirm the loss and decrease in pulmonary volumes related to to the surgery. However, the results obtained in the PO and in in the pre-high proved that through the NIV in CPAP mode, it was able to restore much of the lung volumes, and the variables FVC, PEF, FEV1/FVC and FEF25-75 showed a significant statistically increase.

These findings are similar to those of a randomized controlled trial that investigated the effects of positive pressure on lung function in patients undergoing upper abdominal surgery. In this study, Tenorio Lima e Santos (2010) evaluated 43 patients divided into three groups: a) individuals using incentive spirometer associated with conventional physiotherapy b) individuals who used Expiratory Positive Airway Pressure (EPAP) associated with conventional physiotherapy, and c) individuals who used CPAP associated with conventional physiotherapy. This author noted that CPAP improved gas exchange, served in the preservation of lung volumes and preventing atelectasis (TENÓRIO; LIMA, SANTOS, 2010).

Silveira et al. (2011) in a literature review, analyzed several studies, including one that compared the use of incentive spirometry (IR) with a group that made use of CPAP and another group that used BiPAP, all associated with conventional physiotherapy. In this study, the use of NIV caused a significant improvement in variable tidal volume (VT), FEV1, partial pressure of oxygen in the blood (PaO 2) and produced a significant decrease in shunt fraction.

Another study analyzed by Silveira et al. (2011) showed that CPAP contributed to the significant improvement in PaO2 (p = 0.0079) in patients undergoing to CC, improved gas exchange index (p = 0.0058) and SaO2 (p <0.001), demonstrating efficacy in reversing hypoxemia and improved tissue perfusion and may have contributed to the improvement in lung function of these patients. In contrast, in the same review, a study did not verify superiority of NIV in CPAP mode, compared to conventional physiotherapy, when analyzing the variables VC, FVC, FEV1, PEF, FEF 25-75% and inspiratory muscle strength in the 5th postoperative surgery rate.

Almada, Barros and Santos (2011) argue that the use of NIV as a therapeutic modality aims to improve alveolar ventilation and gas exchange, increasing lung volumes, prevent or reverse atelectasis, decrease the work of breathing, time on mechanical ventilation , avoiding reintubation and resulting in a shorter hospital stay in the Intensive Care Unit.

The present study showed some limitations such as small sample size, short intervention time with the application of

positive pressure and the absence of a control group undergoing to conventional physiotherapy only, so it is necessary to continue this research aimed at increasing the sample size for the correct extrapolation of results.

5 CONCLUSION

Cardiac surgery has been performed with great frequency and despite technological advances, it is still not possible to prevent the development of CPs and the impairment of pulmonary function of patients undergoing this surgical procedure. Physiotherapy has been a strong ally in the prevention, as in the reversal of pulmonary dysfunction developed In the postoperative of cardiac surgery.

The NIV is a feature that has been shown to be effective in restoring lung volumes reduced by surgery. The results of this study indicate that NIV associated with respiratory physiotherapy produced beneficial effects on lung function and contributed on increasing lung volume in patients who underwent cardiac surgery.

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Rua Conselheiro Trockel, 408, casa 2, Bairro Verena,
CEP: 96820-510, Santa Cruz do Sul – RS, Brasil

BEHAVIOR OF LUNG FUNCTION IN PATIENTS SUBMITTED TO CARDIAC SURGERY

ABSTRACT

Currently 275.000 cardiacsurgeries are accomplished in all over the world, with operative mortality around 1 to 15%. In spite of technological advances, the pulmonary complications (PCs) are often observed and the commitment of pulmonary function portrays an important cause of morbidity and mortality in the PO. The non-invasiveventilation (NIV) have been used in orderto reverse orsoftenthatfact. Was evaluate whether non-invasive continuous positive pressure (CPAP) applied in pos-operative (PO) of cardiac surgery (CS) promotes increasing in pulmonary volumes. The sample was consisted by individuals under went to CS at Hospital Santa Cruz. The pre-operative evaluation and the spirometry were accomplished to measure the pulmonary volumes in pre-operative, PO and pre-discharging. About the 1º day after the extubation, CPAP was applied with variable PEEP between 8 and 15 cmH2O, around 15 and 20 minutes, twice a day, untildischarging. Eightpatientswereevaluated, withage of 47,5± 17,44 yearsoldand IMC around 27,73±4,85 Kg/m2. Three (03) individuals showed normal weight, two (02) showoverweight, and three (03) showed obesity type I. The following variables showed significant reduction when compared to the values of PO to pre-operativeones: CVF, VEF1, PEF and FEF25-75(p<0,002), (p< 0,010). Moreover, in CVF, PEF, FEV1/CVF and FEF25-75(p<0,005) (p<0,30), there was a significant improvement when compared the pre-discharging volumes to pos-operativeones. The following variables indicate that NIV contributed for the increasing for pulmonary volumes of patients under went to cardiac surgery.

KEYWORDS: continuous positive airway pressure; pulmonary function; cardiacsurgery.

COMPORTEMENT DE LA FONCTION PULMONAIRE CHEZ LES PATIENTS QUI ONT SUBI UNE CHIRURGIE CARDIAQUE

RÉSUMÉ

Actuellement, sontrealisésenviron 275.000 chirurgiescardiaquesdansle monde entier, avec une mortalitéopératoireallant de 1 à 15%. Malgrélesprogrèstechnologiques, lescomplicationspulmonaires (CPs) sontfréquemmentobservésetl'altération de lafonctionpulmonaire est une cause importante de morbidité et de mortalitédanslepostopératoire (PO).La ventilation non invasive (VNI) a étéutiliséafin d'inverser ou deminimiseruntelcadre. Déterminer si lapression positive continue (CPAP) appliquéede manière non invasivedansle PO de chirurgiecardiaque (CC)

favorise une augmentationdu volume pulmonaire. L'échantillon a étécomposé de personnesquiont subi CC à l'(HSC). Ontétéréaliséesl'évaluationpréopératoireetlaspirométriepourmesurerles volumes pulmonairesdanslepréopératoire, PO et avantlasortiedupatient. Dèsle 1er jouraprèsl'extubation, a étéappliquéela CPAP aveclavariable PEEP de 8 à 15 cmH2O pendant 15 à 20 minutes, deuxfois par jourjusqu'àlasortiedupatient de l'hôpital. Ontétéévalués 08 patientsavecunâgemoyen de47, 5 ± 17,44 ansetl'IMCde 27,73 ± 4,85 kg/m2. Trois (03) dessujetsavaientunpoids normal, deux (02) étaientensurpoids, ettrois (03) ontpresentéobesitétype I. Lesvariablessuivantesontmontréune réductionsignificative de valeursdu PO par rapportauxvaleurspréopératoires: CFV, VEF1, PEF et FEF 25-75 (p <0,002), (p <0,010). Par ailleurs, dansla CVF, PEF, VEF1/CVF et FEF 25-75, il y a eu une améliorationsignificative de volumes avant lasortiedupatient de l'hôpitalpar rapportauxvolumes dupostopératoire (p <0,005), (p <0,30).Lesrésultatsindiquent que VNIcontribue à l'augmentationdes volumes pulmonaires chez lespatientsayant subi une chirurgiecardiaque.

MOTS-CLÉS: pressionpositive continue pardesvoiesaériennes, lafonctionpulmonaire, lachirurgiecardiaque.

COMPORTAMIENTO DE LA FUNCIÓN PULMONAR EN PACIENTES SOMETIDOS A LA CIRUGÍA CARDÍACA

RESUMEN

Actualmente son realizadas cerca de 275.000 cirugías cardíacas en todo el mundo, con mortalidad operatoria oscilando de 1 a 15%. A pesar de los avanzos tecnológicos, las complicaciones pulmonares (CPs) son a menudo observadas y el comprometimiento de la función pulmonar representa una importante causa de morbidez y de mortalidad en el posoperatorio (PO). La ventilación no invasiva (VNI) ha sido utilizada con el intuito de reverter o amenizar tal cuadro. Evaluar si la presión positiva continua (CPAP) aplicada de modo no invasivo en el PO de cirugía cardíaca (CC) promueve incremento de los volúmenes pulmonares. La muestra fue constituida por individuos sometidos a la CC en el HSC. Fueron realizadas la evaluación preoperatorio y espirometría para mensurar los volúmenes pulmonares en los momentos preoperatorio, PO y prealta. A partir del primer día tras extubación, fue aplicada a CPAP con PEEP variable de 8 a 15cmH2O, por 15 a 20 min, dos veces al día, hasta la alta hospitalaria. Fueron evaluados 08 pacientes, con edad media de 47,5± 17,44 años y IMC de 27,73±4,85 Kg/m2. Tres (03) individuos presentaron peso normal, dos presentaron sobrepeso, y tres (03) presentaron obesidad tipo I. Las siguientes variables presentaron reducción significativa cuando comparados los valores del PO a los del preoperatorio: CVF, VEF1, PEF e FEF25-75 (p < 0,002),(p< 0,010). Además, en la CVF, PEF, VEF1/CVF y FEF25-75, hubo mejora significativa cuando comparados los volúmenes pre alta a los del posoperatorio(p<0,005), (p<0,30). Los resultados indican que la VNI contribuye para el incremento de los volúmenes de los pacientes sometidos a la cirugía cardíaca.

PALABRAS CLAVE: Presión positiva continúa en las vías aéreas, función pulmonar, cirugía cardíaca.

COMPORTAMENTO DA FUNÇÃO PULMONAR EM PACIENTES SUBMETIDOS À CIRURGIA CARDÍACA

RESUMO

Atualmente são realizadas cerca de 275.000 cirurgias cardíacas em todo o mundo, com mortalidade operatória oscilando entre 1 a 15%. Apesar dos avanços tecnológicos, as complicações pulmonares (CPs) são frequentemente observadas e o comprometimento da função pulmonar representa importante causa de morbidade e mortalidade no pós-operatório (PO). A ventilação não invasiva (VNI) tem sido utilizada com o intuito de reverter ou amenizar tal quadro. Avaliar se a pressão positiva contínua (CPAP) aplicada de modo não invasivo no PO de cirurgia cardíaca (CC) promove incremento dos volumes pulmonares. Amostra foi constituída por indivíduos submetidos à CC no HSC. Foram realizadas a avaliação pré-operatória e espirometria para mensurar os volumes pulmonares nos momentos pré-operatório, PO e pré-alta. A partir do 1º dia após extubação, foi aplicada a CPAP com PEEP variável de 8 a 15 cmH2O, por 15 a 20 min, duas vezes ao dia, até a alta hospitalar. Foram avaliados 08 pacientes, com idade média de47,5± 17,44 anos e IMC de 27,73±4,85 Kg/m2. Três(03) indivíduos apresentaram peso normal, dois (02) apresentaram sobrepeso, e três (03) apresentaram obesidade tipo I.As seguintes variáveis apresentaram redução significativa quando comparados os valores do PO aos do pré-operatório: CVF, VEF1, PEF e FEF25-75 (p < 0,002), (p< 0,010).Além disso, na CVF, PEF, VEF1/CVF e FEF25-75, houve melhora significativa quando comparados os volumes pré-alta aos do pós-operatório (p<0,005), (p<0,30). Os resultados indicam que a VNI contribui para o incremento dos volumes pulmonares dos pacientes submetidos à cirurgia cardíaca.

PALAVRAS-CHAVE: pressão positiva contínua nas vias aéreas, função pulmonar, cirurgia cardíaca.