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Preoperative optimization with levosimendan in heart failure patient undergoing thoracic surgery

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ABSTRACT

INTRODUCTION: We present the case of a patient with dilatative cardiomyopathy waiting for heart transplantation with pleural effusion to be subjected to pleural biopsy, treated with preoperative infusion of levosimendan to improve heart performances.
PRESENTATION OF CASE: A 56-year-old man (BMI 22,49) with dilatative cardiomyopathy (EF 18%) presented right pleural effusion. The levosimendan treatment protocol consisted of 24 h continuous infusion (0,1 ug/kg/min), without bolus. The patient was under continuous hemodynamic monitoring prior, during and after levosimendan administration. The surgery for pleural biopsy was performed with uniportal Video Assisted Thoracoscopic approach (VATS).
DISCUSSION: A significant increase of Cardiac Index (CI) and Stroke Volume Index (SVI) were observed at 4 h after infusion initiation and was sustained during the next 24 h after the end of infusion. Levosimendan administration was safe.
CONCLUSION: In this case the prophylactic preoperative levosimendan administration is safe and effective in cardiac failure patient undergoing thoracic surgery, but prophylactic preoperative levosimendan treatment in these patients merits further study.

1. Introduction

Heart failure is an important risk factor for mortality and cardiovascular complications after non cardiac surgery [1,2]. Levosimendan, in contrast to other positve inotropic agents, has the advantage to improve cardiac performance and hemodynamics in CF patients without increasing myocardial oxygen consumption or showing any proarrhythmic effects [3].

The use of levosimendan for perioperative optimization of patients undergoing cardiac surgery has been reported in several studies [4,5], however it has not been thouroughly evaluated in cardiac failure patients undergoing non cardiac surgery.

We present the case of a patient with dilatative cardiomyopathy waiting for heart transplantation with pleural effusion to be subjected to VATS for pleural biopsy, treated with preoperative infusion of levosimendan to improve heart performance.

Consent was obtained from the patient.

2. Presentation of Case

A 56-year-old man (height 170 cm, weight 65 kg, BMI 22,49) with dilatative cardiomyopathy (EF 18%) presented right pleural effusion. Cytological examination of pleural fluid was not diagnostic to exclude a malignancy therefore needed surgical pleural biopsies to get diagnosis in order to be put in list for transplantation.

The patient previously underwent surgery for aortic and mitral valve replacement and implanted a pacemaker (INCEPTA CRT-D P162).

The patient was admitted to our PACU the day before the surgery for levosimendan administration.

The levosimendan treatment protocol consisted of 24 h continuous infusion (0,1 ug/kg/min), without bolus. The patient was under continuous hemodynamic monitoring prior, during and after levosimendan administration.

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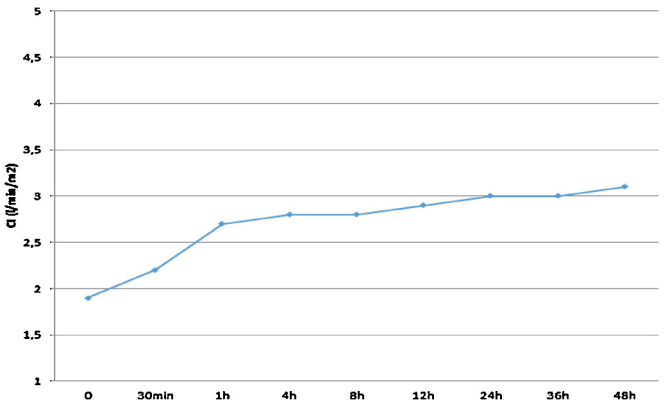

Fig. 1. Changes in Cardiac Index.

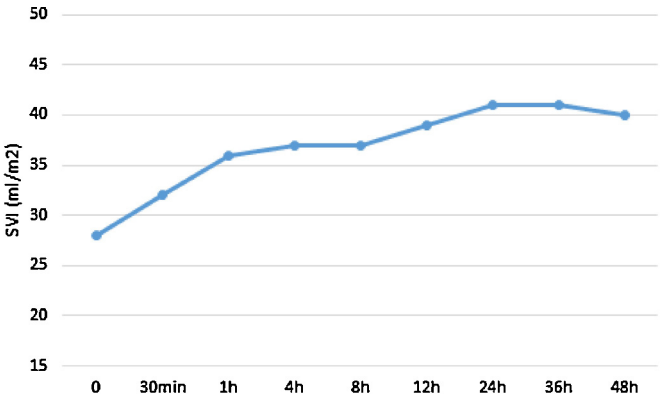

Fig. 2. Changes in Stroke Volume Index.

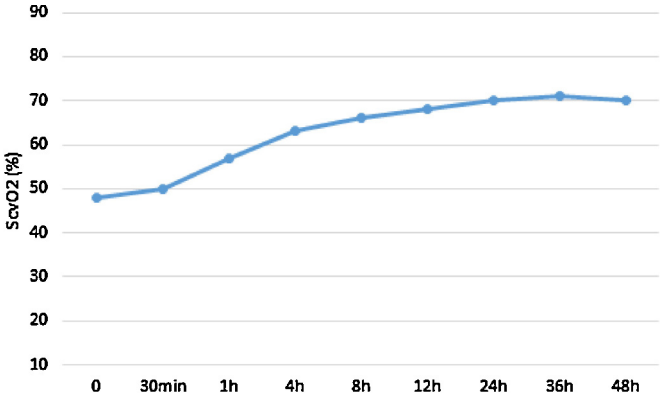

Fig. 3. Changes in Central Venous Oxygen Saturation.

The monitoring included continuous heart rate monitoring via electrocardiogram, arterial blood pressure via femoral artery catheter, urine output, pulse oximetry, PVC throught venous catheter in internal jugular vein, cardiac output (CO), cardiac index (CI), stroke volume index (SVI), central venous oxygen saturation ($ScvO_2$) and oxygen delivery (DO_2) via EV1000 (Edwards Lifesciences). Blood tests were performed every 12 h and blood gas analysis every 4 h. Before levosimendan infusion CI was 1,9, SVI was 28, $ScvO_2$ was 48%. The surgery was performed at the end of levosimendan treatment.

Intraoperative monitoring included continuous electrocardiogram, SpO2, blood pressure, bispectral index monitor (BIS), train of four watch (TOF), INVOS 5100C cerebral somatic oximeter (Medtronic, Dublin, Ireland) to assess the cerebral oxygenation, EV1000 to asses emodinamic parameters. Midazolam premedication (0,03 mg/kg) was administere i.v. 10 min before induction of anesthesia. General anesthesia was induced with a target controlled infusion of propofol/remifentanil and rocuronium bromide (0,6 mg/kg) and manteined with propofol/remifentanil and supplemental bolus of rocuronium accorded TOF values. A left DLT 39 Fr (Rusch, Durham, NC) was positioned and checked with FOB, the lungs were mechanically ventilated with an oxygen-air mixture (FiO_2 50%), the OLV was performed with CMV-AF 5 ml/Kg, RR for $EtCO_2$ <40 mmHg, PEEP 5.

The surgery for pleural biopsy was performed with uniportal Video Assisted Thoracoscopic (VATS) approach at V intercostal space. The time of intervention was 70 min. One thoracic drainage was placed at the end of surgery. Patient awake comfort full.

No complicances occured during anesthesia and hemodinamic and respiratory parameters were stables during surgery.

The monitoring was continued postoperatively in the PACU until 24 h post infusion.An evident increase of CI and SVI were observed at 4 h after infusion initiation and was sustained during the next 24 h after the end of infusion (Fig. 1 and Fig. 2). Additionally, $ScvO_2$ was increased at 4 h after infusion initiation and kept increasing during the 24 post infusion hours. (Fig. 3). Levosimendan showed no harmfull effect on HR, SAP, DAP or MAP, administration was safe, no adverse drug reaction or complication occurred during follow up.

Pleural biopsies reported histological evidence of chronic pleurisy.

3. Discussion

A decreased preoperative EF has been associated with increased postoperative morbidity and mortality, while perioperative left ventricular dysfunction is one of the major predictors of postoperative cardiac complication [6].

During the last years an increasing number of patients with high perioperative risk and decreased left ventricular function are referred to cardiac and non cardiac surgery; heart failure is the major cause of perioperative morbidity and mortality.

The effect of levosimendan as an inodilator are based on a triple mechanism of action that provides positive inotropy equal or even superior to any of the other commercially available inotropic agents with a neutral effect on oxygen consumption and with preconditioning, cardioprotective, antistunning and antischemic effects [7–13].

Levosimendan produces significant dose-dependent increases in stroke volume and cardiac output and decreases in pulmonary capillary wedge pressure, mean blood pressure, mean pulmonary artery pressure, mean right atrial pressure ant total peripheral resistance [14].

Clinical studies show that levosimendan effectively improves general and pulmonary haemodynamics in patients undergoing cardiac surgery, thereby reducing the need for inotropic agents and mechanical circulatory support and additionally optimising renal and hepatic function.

The unique inotropic and cardioprotective properties of levosimendan can provide sustained effects for several days and can thus help to reduce complications in the postoperative period [4].

Tritapepe and collegues reported that short infusion of levosimendan before the initiation of CABG results in higher postoperative cardiac index and lower troponina concentration, in significant reductions in tracheal intubation time, length of ICU stay and number of patients requiring inotropic support [15].

In a randomized trial vs placebo, Levin and collegues evaluated the effects of 23 h infusion preoperative levosimendan in high risk patients with severe left ventricular dysfunction undergoing CABG with cardiopulmonary bypass (EF < 25%). Levosimendan group had a lower incidence of complicated weaning from CPB, decresed mortality and lower incidence of LCOS, lower requirement for inotropes and intra-aortic ballon pumps [16].

Taking into account these multiple but complementary mechanisms, levosimendan appears to be a suitable agent for preoperative optimization of cardiac functions in heart failure patients undergoing major elective surgery [17,18], but has not been thoroughly evaluated in CF patients undergoing thoracic surgery.

We evaluated the effects of prophylactic preoperative levosimendan administration in a CF patient undergoing thoracic surgery in uniportal VATS in general anesthesia.

Considering that in case like this it is not unusual to have unilateral effusion especially since the left chest/pleura was transversed through previous operation and therefore adhesion formation in the space would limit a visible effusion on the left, pleural biopsy could seem an overtreatment, but the transplant list required us to have the assurance about not being a malignant lesion, regardless of clinical probability.

The high risk related to general anesthesia in not negligible, but pleuroscopy or thoracoscopy in local anesthesia allow surgeons to take samples in the more favorable area of the pleura with random biopsies. In our case we need to get that specific effusion, in the dorsal apex area of the lung, so lung collapse was needed.

Hemodynamic monitoring was performed with EV 1000 (Edwards Lifesciences).

The EV1000 clinical platform presents the physiologic status of the patient in an intuitive and meaningful way and offers you scalability and adaptability for both the OR and ICU.

With EV 1000 we have monitored hemodynamic optimization. Cardiac output, CI, SVI measured continuously can be used (in combination with SaO2 and hemoglobin) to monitor and optimize DO2 with fluid and inotropic agents [19,20].

In our CF patient levosimendan increases CI, SVI and $ScvO_2$. Levosimendan administration in a 24 h continuos infusion resulted in benefical improvement of patient's hemodynamics and cardiac performance, effects that were sustained for at least another 24 h and, in the case of EF, 7 days. No difference was noted between CI, SVI, Do2 values at the end of levosimendan infusion and the postoperative values. The finding that this optimization was substained constantly throughout the intra and postoperative period, when the surgical stress is greater.

4. Conclusion

In conclusion, in our experience the prophylactic preoperative levosimendan administration is safe and effective in cardiac failure patient undergoing thoracic surgery. Levosimendan could be safely administrered to CF patients undergoing thoracic surgery, but prophylactic preoperative levosimendan treatment in these patients merits further study.

Conflict of interest

The authors have no conflict of interest.

Funding

The authors have no sources of funding.

Ethical approval

In our case report was not made no experimentation, you just described our clinical practice.

Consent

In our case report was not made no experimentation, you just described our clinical practice, written informed consent for procedures was obtained from the patient.

Author contribution

Nespoli Moana Rossella: study design, writing the paper.
Marco Rispoli: study design.
Dario Maria Mattiacci: data collection.
Esposito Marianna: data collection.
Antonio Corcione: data analysis.
Carlo Curcio: data interpretation.
Salvatore Buono: data analysis and interpretation.

Guarantor

Nespoli Moana Rossella.

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