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CLINICAL INFORMATION

Levosimendan as a treatment for acute renal failure associated with cardiogenic shock after hip fracture



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KEYWORDS

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Abstract Inotropic drugs are part of the treatment of heart failure; however, inotropic treatment has been largely debated due to the increased incidence of adverse effects and increased mortality. Recently levosimendan, an inotropic positive agent, has been proved to be effective in acute heart failure, reducing the mortality and improving cardiac and renal performance. We report the case of a 75-year-old woman with history of heart and renal failure and hip fracture. Levosimendan was used in preoperative preparation as an adjuvant therapy, to improve cardiac and renal function and to allow surgery.

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PALAVRAS-CHAVE

Levosimendana;
Choque cardiogênico;
Insuficiência renal;
Fratura de quadril;
Cuidados perioperatórios

Levosimendana como tratamento para insuficiência renal aguda associada a choque cardiogênico após fratura de quadril

Resumo Fármacos inotrópicos fazem parte do tratamento de insuficiência cardíaca; no entanto, o tratamento com inotrópicos tem sido amplamente debatido devido ao aumento da incidência de efeitos adversos e da mortalidade. Recentemente, levosimendana, um agente inotrópico positivo, vem provado ser eficaz na insuficiência cardíaca aguda, reduzindo a mortalidade e melhorando o desempenho cardíaco e renal. Relatamos o caso de uma paciente de 75 anos de idade, com história de insuficiência cardíaca e renal e fratura de quadril. Levosimendana foi usada na preparação do pré-operatório como terapia adjuvante para melhorar a função cardíaca e renal e permitir a cirurgia.

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Introduction

During perioperative period the development of acute heart failure increases morbidity and mortality.¹ Cardiac failure is an important public health problem; its incidence amounts to 6–10% in the population over 65 years. Levosimendan (Simdax® – Orionpharma) is a recommended treatment for acute heart failure.² Its mechanism of action allows for an increase in contractility³ and a reduction in both preload and afterload, improving stroke volume and cardiac output without adversely affecting diastolic function.^{4,5} The haemodynamic positive effects of levosimendan induce also a positive result on tissular perfusion, as reported when the drug has been employed in treating cardiogenic shock associated with renal failure.⁶ Currently, there are few studies about the preoperative use of levosimendan in patients undergoing non-cardiac surgical procedures.⁷

We report the case of a patient with a hip fracture; she developed acute renal failure secondary to cardiogenic shock before undergoing surgery for fracture reduction. Levosimendan was introduced in the treatment with the aim of improving cardiac and renal functions; finally, it results in an effective tool for weaning the patient from hemofiltration before surgery.

Case description

A 75-year-old woman with history of hypertension, chronic atrial fibrillation, congestive heart failure with baseline LVEF of 30%, an episode of pulmonary embolism in 2004, chronic renal failure (baseline creatinine 2.2 mg/mL), obstructive sleep apnea-syndrome associated with morbid obesity, and dyslipidemia, was admitted to the emergency department because of accidental fall with petrochanteric fracture of the right femur.

During admission in ward, pending surgery, a tachyarrhythmia, probably associated with the acute anaemia, provoked an acute cardiac failure that presented together acute renal failure. The patient was subsequently transferred to the Intensive Care Unit (ICU).

Once in the ICU, the patient received basic monitoring (ECG, pulseoximetry) and advanced haemodynamic monitoring, using central venous access (right internal jugular vein) and central arterial line (left femoral artery) and employing LiDCO™ plus system (LiDCO Ltd, Cambridge, UK). The parameters on admission in ICU were: invasive blood pressure 90/60; heart rate 120 beats per minute (ECG showed atrial fibrillation); SpO₂ 93% (with 0.5 FiO₂); cardiac index: 2.4 L/min/m², systemic vascular resistance 2500 dynes/cm.⁵ The patient showed oliguric acute renal failure (serum creatinine: 4.7 mg/dL; urea: 155 mg/dL) and fluid overload (positive balance of 1787 mL in the last 24 h) refractory to therapy with diuretics. For these reasons renal replacement therapy was started with continuous veno-venous hemofiltration (CVVHF), coupled to non-invasive ventilation: Bi-level Positive Airway Pressure (BiPAP).

Persistent haemodynamic instability and hypotension were treated starting vasopressor therapy with nor-epinephrine at doses of 0.04 mcg/kg/min. In lack of improvement, a trans-thoracic echocardiography was performed, which diagnosed systolic and diastolic dysfunction

associated with pulmonary arterial hypertension, without signs of recent thromboembolism.

In order to optimize the patient preoperatively and improve kidney function, it was decided to start a treatment with levosimendan at 0.05 mcg/kg/min, avoiding the induction bolus and gradually increasing the dose up to 0.1 mcg/kg/min, according to the haemodynamic response and the tolerance of the patient.

Progressive improvement in renal function, recovering spontaneous and satisfactory urine output and improved analytical values allowed suspending renal replacement therapy prior to surgery.

The patient underwent surgery on day 17 of admission, under spinal anaesthesia. The intervention was marked by significant blood loss that required intraoperative transfusion of 3 units of packed red blood cells and 2 units of fresh frozen plasma, and postoperative transfusion of 4 units of packed red cells and 2 units of fresh frozen plasma, without recording any dysfunction in cardiac performance. On day 24, the patient was discharged to the ward without any renal replacement therapy or vasoactive treatment.

Discussion

Due to its high morbidity and mortality in the perioperative period, heart failure in patients undergoing non-cardiac surgery should be identified and treated at an early stage to ensure adequate preoperative optimization and to achieve better haemodynamic conditions prior to surgery.

Renal failure is highly prevalent in patients with chronic heart failure; it could have an incidence of up to 25%.⁸ Furthermore, this fall in glomerular filtration could worsen morbidity and mortality in acute heart failure.⁹

There are few studies on the effectiveness of preoperative therapy for preventing and treating the deterioration of cardiac function in patients undergoing major surgery.^{7,10} Prophylactic use of conventional inotropic drugs is controversial: it may cause an increase in myocardial oxygen consumption, vasodilation and risk of arrhythmias.¹¹

After its recent introduction in clinical practice, levosimendan, thanks to an original mechanism of action, has been proved to be effective in achieving an improvement in cardiac function and perfusion of tissues and to be associated with a significant reduction in mortality in critically ill patients.¹² The drug has been reported to present even anti-inflammatory, anti-oxidant and anti-apoptotic effects.¹³ Levosimendan has showed a beneficial effect on renal function in patients with established renal failure, probably because of the raise in renal blood flow, due to the increased cardiac output, vasodilation and possible anti-inflammatory properties.^{6,14}

In the present case, levosimendan was used as preoperative treatment in order to optimize cardiac performance and to improve renal function before surgery. The treatment proved to be effective; the patient was successfully withdrawn from renal replacement, and she was submitted to the intervention and she showed to possess an effective cardiac function, since she resisted to acute and huge changes in intravascular volume.

The treatment protocol, recommended by levosimendan informative sheet, consists in a loading dose of 2.4 mcg/kg,

in a rapid infusion of approximately 10 min, followed by a continuous infusion of 0.1 mcg/kg/min for 24 h. In patients with acute myocardial failure, the administration of a loading dose has been associated with hypotensive episodes, difficult to control with vasopressor drugs.¹⁵ In order to avoid these hypotensive episodes that may worsen, instead of improving, patient's prognosis, some authors recommend a more careful protocol, consisting in no loading dose and a gradual increasing in infusion rate.¹⁵ In the present case, the progressive introduction of levosimendan infusion was not associated to hypotensive episodes or an augmentation in vasoconstrictors requirement. The reduced systemic resistance showed only the beneficial face of the medal, increasing renal perfusion and improving microcirculation.

Conclusion

Levosimendan may constitute a valid choice to be considered in the management of preoperative decompensated heart failure associated with renal insufficiency. The main property of the drug (inotropic and vasodilation positive effects) allowed to restore renal function and to prepare the patient for the intervention. Moreover, the new equilibrium, between increased cardiac function and beneficial vasodilation, was helpful during and after intervention because it allowed the cardiovascular system of our patient to deal with the consequences of haemorrhage and fluid therapy.

Conflicts of interest

The authors declare no conflicts of interest.

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