

Research Article

Levosimendan In Cardiology and Cardiac Surgery

M. Abdelbaki¹, Y. Sayad², A. Boureghda³

¹EPH Mixte colonnel LOTFI Laghouat, Algérie.

²EHS CNMS, Alger.

³CHU de Blida, Algérie.

Received: 05 September, 2023

Accepted: 08 October, 2023

Published: 14 October 2023

Abstract:

Introduction: levosimendan is an inodilator successfully used in the treatment of acute and chronic heart failure. Its use in the treatment of low cardiac output syndrome pre- and postoperatively after cardiac surgery under extracardiac circulation is poorly documented, but it appears to be a very interesting alternative in terms of morbimortality.

Aim of the study: to evaluate the value of levosimendan versus dobutamine in the rapid weaning of inotropic drugs in low output patients awaiting cardiac surgery and after surgery under extracorporeal circulation.

Materials and methods: sixty patients with low cardiac output syndrome before surgery on levosimendan and after cardiac surgery on extracorporeal circulation, requiring positive inotropic and vasopressor drugs (dobutamine ± noradrenaline). Post-operatively, in the context of drug weaning, we identified two groups : levosimendan group (n=30) and dobutamine group (n=30). In the levosimendan group, dobutamine was replaced immediately postoperatively by levosimendan. Hemodynamic parameters (MAP, HR, CI, ESV, SVR), ICU length of stay and 30-day mortality were assessed and compared between the two groups of patients.

Results: Cardiac index was significantly higher in the levosimendan group than in the dobutamine group (2.8 [0.3] l/min/m² versus 2.3 [0.4] ml/min/m²) respectively, P

Conclusion: the use of levosimendan in the treatment of low cardiac output syndrome before and after cardiac surgery with extracorporeal circulation resulted in rapid improvement in hemodynamic status with a short intensive care unit stay and low mortality.

Keywords: levosimendan, cardiac surgery, extracorporeal circulation, low cardiac output syndrome, hemodynamics.

I. Introduction:

Cardiac surgery is a surgery with a high risk of complications, especially when leaving the extracorporeal circulation. Low cardiac output syndrome sometimes requires a long period of administration of inotropic support, including catecholamines, which themselves can lead to deleterious side effects such as increased oxygen consumption, tachycardia and increased systemic afterload.

Also, phosphodiesterase inhibitors such as milrinone, often used, can have deleterious effects on neurohormone and intracellular calcium levels.

Levosimendan, a calcium sensitizer, had more recently emerged as an alternative agent in these situations. Commonly used in the decompensation of heart failure, it may play an important role as a perioperative agent in cardiac surgery.

The aim of our work is to demonstrate the value of levosimendan in the rapid postoperative improvement of hemodynamics and hence the rapid postoperative weaning of conventional inotropic drugs and their side effects in cardiac surgery under extracorporeal circulation.

II. Materials and methods:

Sixty patients who underwent cardiac surgery under

extracorporeal circulation between January 2020 and March 2021 and who presented a low cardiac output syndrome before surgery until the end of extracorporeal circulation and necessitated the use of positive inotropic drugs (dobutamine) associated with vasopressor drugs (noradrenaline). Postoperatively, these patients were divided into two groups: dobutamine + norepinephrine (GD=30) at 5-10µg/kg' and levosimendan + norepinephrine (GL=30) at 0.1-0.2µg/kg', after substitution of dobutamine and gradual reduction of norepinephrine, with the aim of maintaining levosimendan alone for 24 hours.

The primary endpoints were hemodynamic parameters (mean arterial pressure, cardiac index, stroke ejection volume, systemic vascular resistance and heart rate). These parameters were measured by the Most Care monitor connected to a blood arterial line, which measures cardiac output by analyzing the air under the blood pressure curve.

These parameters were collected just before the start of treatment with inotropic drugs and then at 6, 12, 24 and 48 hours (H0, H6, H12, H24 and H48).

III. Results:

Sixty patients were included in the study: thirty (30) in the

levosimendan (GL) group and thirty (30) in the dobutamine (GD) group.

Table I shows the clinical and demographic data of all patients included in the study. No significant differences were found between the two groups.

Tableau I: patient data.

	Levosimendan Group N=30	Dobutamine Group N=30
Age (an)	58 ± 6	57 ± 8
Sex (n/%)		
- Female	9(30)	10(35)
- Male	21(70)	20(65)
BMI	24.92 ± 3.47	24.41 ± 5.51
Euroscore (n/%)		
- 0-2 (low risk)	8 (27)	9 (30)
- 3-5 (Medium risk)	19 (63)	17 (57)
- = 6 (High risk)	3 (10)	4 (13)
EF (%)	52 ± 5	53 ± 3
Surgical procedure		
- Revascularisation	6 (20)	5 (16)
- Valvulair	24 (80)	25 (84)
CEC		
CEC time (min)	90 ± 15	93 ± 12
Clamping time (min)	71 ± 13	69 ± 14

In both groups, treatment with dobutamine and levosimendan resulted in a significant increase in heart rate, while the cardiac index and systolic ejection volume were greater and more prolonged with levosimendan (figure 1).

Levosimendan has a systemic vasodilator effect, which led to a drop in mean arterial pressure and systemic vascular resistance (figure 1), prompting us to combine a vasopressor drug (noradrenaline) in this group during the first hours of infusion to anticipate the drop in mean arterial pressure.

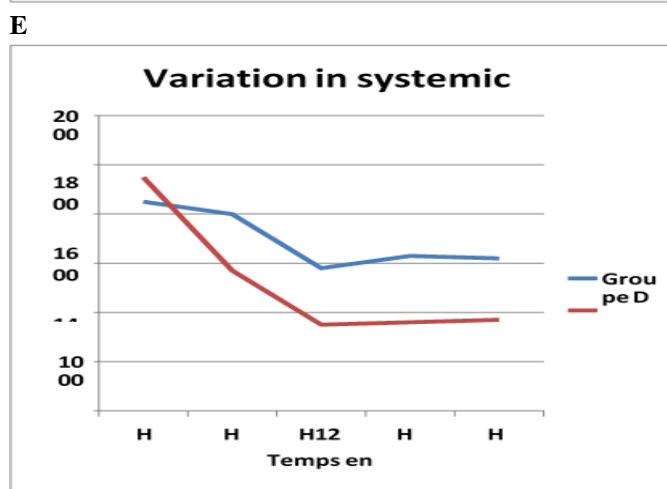
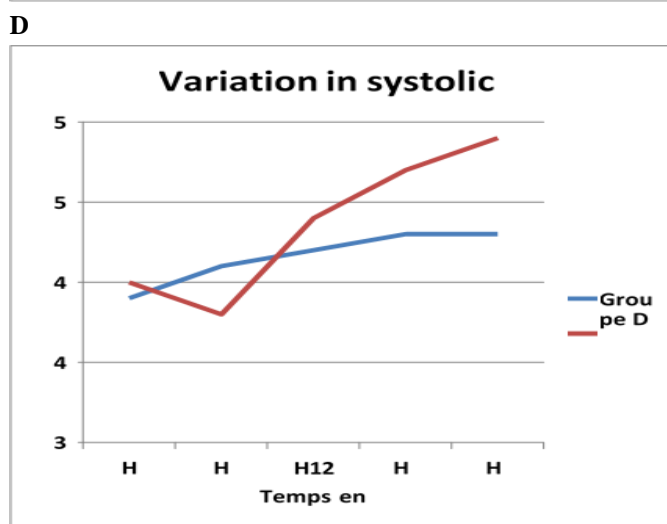
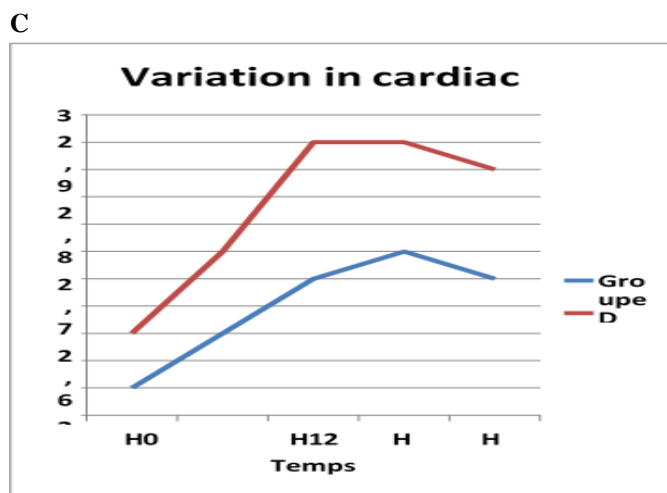
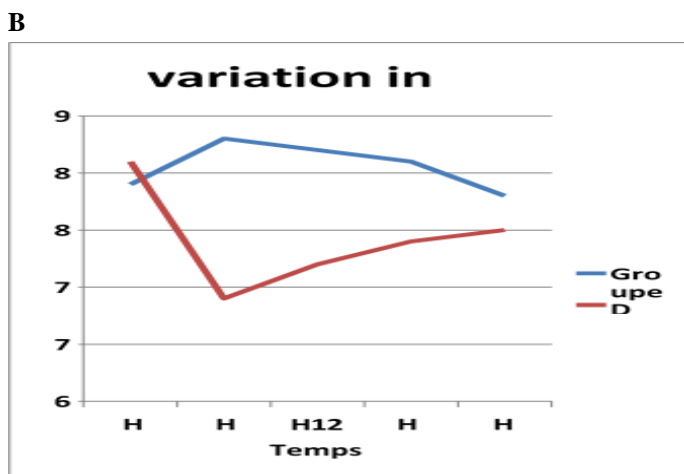
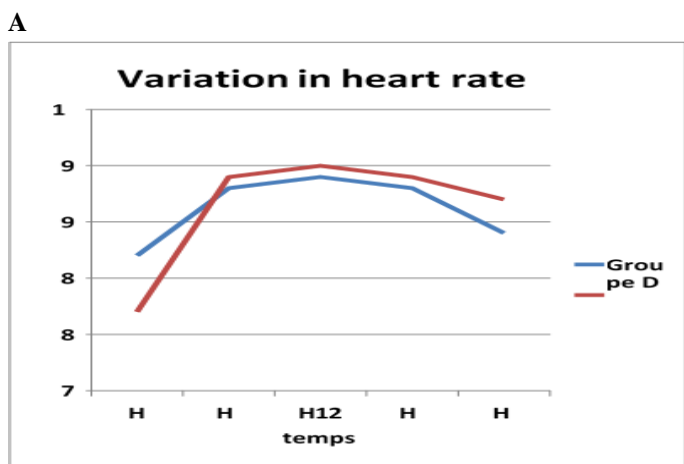


FIGURE 1: Variation in hemodynamic parameters between the two groups as a function of time postoperatively

- A: Heart rate,**
- B: Mean arterial pressure,**
- C: Cardiac index**
- D: Systolic ejection volume,**
- E: Systemic arterial resistance.**

ICU stay was significantly shorter in the levosimendan group (52 ± 4 hours) than in the dobutamine group (60 ± 2 hours), P=0.028.

Postoperative 30-day mortality was significantly higher in the dobutamine group (3 [10%]) than in the levosimendan group (1 [3.33%]), P=0.036.

IV. Discussion:

The preoperative and especially postoperative low cardiac output syndrome due to transient ventricular dysfunction after cardiac surgery on bypass grafts is characterized by an improvement in function during the first hour after the end of bypass, followed by a deterioration that peaks at 4-5 hours after surgery (1).

Transient myocardial dysfunction is induced by ischemia-reperfusion following aortic clamping and is the cause of myocardial sideration. Under these conditions, patients respond to positive inotropic agents, which is the treatment of choice for postoperative low cardiac output syndrome (1, 2,3).

Beta-adrenergic agonists and phosphodiesterase II/IV inhibitors improve hemodynamic parameters, but are associated with the risk of myocardial ischemia and rhythm disorders, and increase mortality. There are few studies on the use of levosimendan in the immediate perioperative period in cardiac surgery (4,5).

One of the main findings of our study was the rapid improvement in hemodynamic parameters in the levosimendan group, resulting in a shorter ICU stay and a reduction in mortality, as confirmed by other studies (4.5.6.7.8.9).

V. Conclusion:

Levosimendan may be the treatment of choice for low-flow syndrome, especially postoperatively in cardiac surgery under extracorporeal circulation, which generates myocardial incompetence.

Immediate replacement of dobutamine and gradual weaning of vasopressor drugs to maintain a mean arterial pressure (MAP) of between 65 and 70 mmHg, with levosimendan significantly improves the cardiac index and lowers systemic arterial resistance (SAR).

The improvement in hemodynamic conditions achieved with levosimendan means that patients can be discharged from the intensive care unit (ICU) to their home department within 24 hours, in contrast to dobutamine, where the length of stay is estimated at 72 hours.

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