Epinephrine for acute decompensated heart failure and low output state: Friend or foe?

Nuccia Morici [a,1], Alice Sacco [a,1], Fabrizio Oliva [c], Stefano Ferrari [a], Roberto Paino [d], Filippo Milazzo [d], Maria Frigerio [c], Roberto Pirola [b], Silvio Klugmann [b], Antonio Mafrici [a,*]

[a] Intensive Cardiac Care Unit, Cardiovascular Department at Niguarda Ca'Granda Hospital, Milan, Italy
[b] Interventional Cardiology, Section 1, Cardiovascular Department at Niguarda Ca'Granda Hospital, Milan, Italy
[c] Heart transplant program, Section 2, Cardiovascular Department at Niguarda Ca'Granda Hospital, Milan, Italy
[d] Intensive Cardiothoracic Care Unit, Cardiovascular Department at Niguarda Ca'Granda Hospital, Milan, Italy

ARTICLE INFO

Article history:
Received 25 February 2011
Accepted 3 March 2011
Available online 24 March 2011

Keywords:
Heart failure
Low-output state
Inotrope

Prevalence of heart failure (HF) is comparable between European countries and the United States, amounting at 2–3% of general population and raising up to 15.8% in people older than 65 years [1–3]. Low-output cardiac failure has been reported only in about 3–10% of those patients, but it's unfortunately associated with an extremely high mortality rate, up to 50% in different study populations [4–7]. This setting of patients has usually been disregarded in epidemiological studies. Previous studies on cardiogenic shock have often used data extrapolated from chronic heart failure trials, they had a relevant clinical heterogeneity and a poor methodological quality, so that summaries of recommendation published by evidence-based organizations come to conflicting results [8]. In a meta-regression analysis evaluating the effectiveness of intravenous inotropic drugs on patients with heart failure, only three trials (75 patients) pertained to patients with cardiogenic shock [9]. These findings, together with the complex and heterogeneous clinical features, may explain the significant variation in the treatment of hospitalized patients with low-output heart failure and a "local-expertise based" approach [10]. A recently published survey on acute heart failure (AHF) has been designed to test the efficacy and safety of specific drugs in this setting of patients, leading to the conclusion that inotrope are associated with worse in-hospital outcome [11]. However in this survey, among patients receiving inotropes in the first 48 h, only 26% were on cardiogenic shock; the inotrope mostly used was dobutamine, followed by dopamine and levosimendan and only a small percentage of cases received epinephrine. Even if the authors applied a propensity score matching to balance for known risk factors, they had however to admit possible limitations in the estimation of treatment effectiveness in a such complex population.

Contrary to current opinion, we think that epinephrine may still have a role in the treatment of patient with low output state. In our center, 35 cases of chronic heart failure acutely decompensated have been collected between 2006 and 2009. These patients are better defined by the Interagency Registry of Mechanically Assisted Circulatory Support (INTERMACS) profile 1 ("crush and burn"), in which worsening organ hypoperfusion requires a fast and effective management within a few hours [12]. They were treated according to the "shock protocol" implemented in our Cardiovascular department and defined as a sum of subsequent steps with increasing therapeutic intensity in order to restore cardiac output and avoid organ impairment.

The first step of the therapeutic approach had the following targets: 1) reach adequate volemic state (central venous pressure between 5 and 10 mm Hg); 2) improve cardiac output and hemodynamic parameters; 3) control heart rate and arrhythmias onset; and 4) avoid acute respiratory failure.

In order to achieve these results we resorted to therapeutic levels at increasing intensity, with hourly reassessment until clinical and hemodynamic stabilization:

1. Subclavian central venous catheterization (SCV) and radial artery cannulation were performed to all the patients in order to get a reliable evaluation of the central venous pressure and continuous pressure recording.
2. Epinephrine infusion was started at 0.05 mcg/Kg/min with rapid titration till target attainment (mean arterial pressure>65 mm Hg, mixed venous saturation >60%);
3. After achieving a stable blood pressure, a sodium nitroprusside infusion was started and tailored in order to normalize loading conditions, vascular resistance and peripheral perfusion.
4. Continuous infusion of moderate dose of loop diuretics was associated to achieve intensive unloading and to improve symptoms.
5. Mechanical ventilation was deemed indicated if blood saturation is <90% with reservoir oxygen therapy, respiratory rate >28–30/min and PCO2 <25 mm Hg.
6. Intra-aortic balloon pump (IABP) was quickly placed in all the cases considered not responding to pharmacological therapy within 1 h since starting the aggressive drug treatments.

A shift in strategy toward earlier implantation of a left-ventricular assist device (LVAD) was considered in case of cardiogenic shock not responding to therapy or in case of worsening the symptoms in inotrope-dependent patients. Potentially eligible patients were considered for heart transplantation. All patients had New York Heart Association class IV symptoms and hemodynamic parameters consistent with severe heart failure, as evidenced by mean LVEF of $20.8 \pm 7.1\%$ (95% CI 18.3–23.2) and systolic blood pressure (SBP) of 83.7 ± 17.2 mm Hg (95% CI 77.0–89.9), suggesting the increased complexity of the study population. The mean length of stay in ICCU was 13.6 days (95% CI 10.5–16.7, min 2–max 41), while total hospitalization length of stay was 38.1 days (95% CI 28.3–47.8, min 4–max 119), both longer than those for other registry patients.

In-hospital death occurred in 17 patients (48.6%). At 1-year follow up, all the patients discharged but one was alive. Nine patients (25.7%) underwent an orthotopic heart transplantation. Re-hospitalization for cardiovascular causes occurred only in 2 patients (5.7%).

It is worth noting that adrenaline infusion did not induce any relevant increase in heart rate (101 ± 18.4 at baseline versus 106 ± 17.6 at the infusion peak), either in life-threatening arrhythmias.

Indeed, we used epinephrine as a "pharmacologic bridge" to cardiac transplantation, another definitive intervention, or a more advanced, intense medical therapy.

It's empirically drawn from our daily work in intensive care that epinephrine use is, mostly, an epiphenomenon of a so severe patient impairment, that inotrope are needed and unavoidable.

High dopamine doses are associated with a more relevant heart rate increase in order to achieve the same hemodynamic target.

* Corresponding author at: Intensive Cardiac Care Unit, Ospedale Niguarda Ca' Granda, Piazza Ospedale Maggiore, 3, 20162 Milan, Italy. Tel.: +39 02 64442576; fax: +39 02 64442818.
E-mail address: antonio.mafrici@ospedaleniguarda.it (A. Mafrici).
[1] Nuccia Morici and Alice Sacco equally contributed and are joint as the first author.

Norepinephrine increases peripheral resistance, and, consequently, afterload, so it's less favorable in this context. Levosimendan has a hypotensive effect, so it has to be associated to a vasopressor in order to be employed. Epinephrine infusion may be a solution to reach a stabilization at least for the few hours needed to plan on how to treat the patient with a more invasive strategy, if applicable. Two major criticisms raised to our work are the following: first, the treatment suggested is out of current guidelines; second, we don't have the tested the small case-series analyzed versus a control group, so we cannot draw any kind of conclusion.

In order to answer to the first question we would like to remember that current guidelines on heart failure and low output state are based on old papers and are poorly designed to address specific issues. A recent editorial on the heart failure treatment has warned against the overzealous use of less-than-perfect guidelines, thereby boosting a "cookbook medicine" at the expense of physician judgment [13].

Alike, recent analysis have shown that current recommendation on the heart failure management are mostly based on expert consensus opinion rather than on higher level of evidence [13].

With regards to the second point, lack of a control, we agree that to show feasibility and safety of the treatment suggested we should engage a comparison with a control group (even if historical).

However the setting of patients considered is uncommon and highly heterogeneous. Furthermore, many differences exist among diagnostic strategies and therapeutic approach in each intensive care unit. In any case, hospital and mid-term follow up mortalities, in our case-series, were comparable to that reported in the literature for patients less severely compromised.

In summary, we haven't created an experimental model, but just told about a real life experience within a rare setting of patients affected by a life-threatening condition.

Guidelines are an important instrument to guide clinical practice, but should be always critically reanalyzed in the specific setting faced.

The authors of this manuscript have certified that they comply with the Principles of Ethical Publishing in the International Journal of Cardiology [14].

References

[1] European Society of Cardiology; Heart Failure Association of the ESC (HFA); European Society of Intensive Care Medicine (ESICM)Dickstein K, Cohen-Solal A, et al. ESC guidelines for the diagnosis and treatment of acute and chronic heart failure 2008: the Task Force for the diagnosis and treatment of acute and chronic heart failure 2008 of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association of the ESC (HFA) and endorsed by the European Society of Intensive Care Medicine (ESICM). Eur J Heart Fail Oct 2008;10(10):933–89.

[2] Hunt SA, Abraham WT, Chin MH, et al. 2009 focused update incorporated into the ACC/AHA 2005 Guidelines for the Diagnosis and Management of Heart Failure in Adults: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines: developed in collaboration with the International Society for Heart and Lung Transplantation. JACC Apr 14 2009;119 (14):e391–479 Epub 2009 Mar 26.

[3] Krum H, Abraham WT. Heart failure. Lancet Mar 14 2009;373(9667):941–55.

[4] Adams Jr KF, Fonarow GC, Emerman CL, et al. Characteristics and outcomes of patients hospitalized for heart failure in the United States: rationale, design, and preliminary observations from the first 100,000 cases in the Acute Decompensated Heart Failure National Registry (ADHERE). Am Heart J Feb 2005;149(2):209–16.

[5] Tavazzi L, Maggioni AP, Lucci D, et al. Nationwide survey on acute heart failure in cardiology ward services in Italy. Eur Heart J 2006;27:1207–15.

[6] Nieminen MS, Brutsaert D, Dickstein K, et al. EuroHeart Failure Survey II (EHFS II): a survey on hospitalized acute heart failure patients: description of population. Eur Heart J 2006;27:2725–36.

[7] Gheorghiade M, Abraham WT, Albert NM, et al. Systolic blood pressure at admission, clinical characteristics, and outcomes in patients hospitalized with acute heart failure. JAMA 2006;296:2217–26.

[8] Myburgh JA. Catecholamines for shock: the quest for high-quality evidence. Crit Care Resusc 2007;9(4):352–6.

[9] Abraham WT, Adams KF, Fonarow GC, et al. In hospital. Mortality in patients with acute decompensated heart failure requiring intravenous vasoactive medications: an analysis from the Acute Decompensated Heart Failure National Registry. J Am Coll Cardiol 2005;46:57–64.

[10] Elkayam U, Tasissa G, Binanay C, et al. Use and impact of inotropes and vasodilator therapy in hospitalized patients with severe heart failure. Am Heart J Jan 2007;153 (1):98–104.

[11] Mebazaa A, Parissis J, Porcher R, et al. Short-term survival by treatment among patients hospitalized with acute heart failure: the global ALARM-HF registry using propensity scoring methods. Intensive Care Med 2011;37:290–301.

[12] Stevenson LW, Pagani F, Young JB, et al. INTERMACS profiles of advanced heart failure: the current picture. J Heart Lung Transplant 2009;28:535–41.

[13] Ghali JK, Bassie BM, Mann D, Rich M. Heart failure guidelines, performance measures, and the practice of medicine: mind the gap. J Card Fail Jan 2011;17(1):90 e1-4.

[14] Shewan LG, Coats AJ. Ethics in the authorship and publishing of scientific articles. Int J Cardiol 2010;144:1–2.

0167-5273/$ – see front matter
doi:10.1016/j.ijcard.2011.03.006

Supra-annular aortic replacement in Behcet's disease: A new surgical modification to prevent valve detachment

Yangfeng Tang, Jibin Xu, Zhiyun Xu *

ARTICLE INFO

Article history:
Received 25 February 2011
Accepted 3 March 2011
Available online 5 April 2011

Keywords:
Behcet's disease
Recurrent valve detachment
Supra-annular aortic replacement

Behcet's disease is a multisystem inflammatory disorder dominated clinically by recurrent oral and genital ulceration, uveitis, and erythema nodosum, which rarely involves the cardiovascular system [1]. However, the cardiovascular complications of Behcet's disease occasionally require surgical intervention. Often, valve replacement is often the only alternative as inflammation-induced tissue fragility completely destroys the native aortic valve [2]. Surgical treatment of this condition carries a high risk of postoperative morbidity as a result of valve detachment or pseudoaneurysms at anastomosis sites [3]. Consequently, we developed a new maneuver for patients with recurrent aortic valve detachment due to Behcet's disease and have obtained good results.

A 41-year-old woman with severe aortic regurgitation was treated in another institute in 2008. She had a history of recurrent aphthous stomatitis and genital ulceration. Aortic valve replacement with a bioprosthesis was performed without any postoperative complication. Cultures of the aortic valve were negative. Clinical and pathological manifestation confirmed the diagnosis of Behcet's disease. Immunosuppressive

* Corresponding author. Tel.: +86 15800629181; fax: +86 21 65490979.
E-mail address: tangyfch265@163.com (Z. Xu).