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# Treatment of Cardiogenic Shock Complicating Acute Myocardial Infraction: Systematic Literature Review

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## Abstract

This review is aiming to discuss, the treatment of cardiogenic shock complicating acute myocardial infraction presented review was conducted by searching in Medline, Embase, Web of Science, Science Direct, BMJ journal and Google Scholar for, researches, review articles and reports, published over the past years. were searched up to November 2018 for published and unpublished studies and without language restrictions, if several studies had similar findings, we randomly selected one or two to avoid repetitive results. On the basis of findings and results this review found levosimendan, a novel in dilator, revascularization, intra-aortic balloon pump (IABP) are the most common treatment of cardiogenic shock complicating acute myocardial infraction.

***Keywords:*** *Treatment; Acute; Cardiogenic Shock Complicating; Myocardial Infraction*

## Introduction

Cardiogenic shock is a state of impaired end-organ perfusion owing to a reduced cardiac output. Evidenced by hypotension and impaired tissue perfusion. It is therefore defined mainly by haemodynamic parameters such as (i) a systolic blood pressure of less than 90 mmHg lasting for more than 30 minutes (in the absence of hypovolaemia) or vasopressors required to achieve a systolic blood pressure ≥ 90 mmHg with (ii) a reduction of cardiac index (< 1.8 L/min/$m^2$ without support and 2.0 - 2.2 L/min/$m^2$ with support, depending on the definition used); and (iii) with elevated left ventricular (LV) filling pressures (pulmonary capillary wedge pressure >18 mmHg). Evidence of vital organ hypoperfusion may be manifested clinically by (i) cool extremities owing to centralization, (ii) decreased urine output, and/or (iii) alteration in mental status. In addition, serum lactate measurements may be used for the assessment of impaired peripheral microcirculation [37,38].

The incidence of cardiogenic shock complicating acute myocardial infraction (MI) has remained constant over 25 years [1,3]. Although in-hospital mortality declined for the first time in the mid-1990s, the overall mortality rate is still 60% [1,3] and cardiogenic shock remains the major cause of death for patients hospitalized with acute MI [2,4]. We previously reported the initial and 1-year results of the randomized should we emergently re-vascularized occluded coronaries for cardiogenic shock (SHOCK) trial [5,6].

Cardiogenic shock (CS) is the leading cause of death in patients hospitalized for acute myocardial infarction (AMI) with mortality rates of up to 60% [7]. Dismal progress 8.9 continue to be associated with CS despite the advancement of the improvement of the therapeutic interventions which aims to improve the perfusion [8,9].

Robert M Califf and James R Bengtson defined syndrome of CS as "the inability of the heart, as a result of impairment of its pumping function, to deliver sufficient blood flow to the tissues to meet resting metabolic demands" [10]. "Mean arterial blood pressure" (MAP) and "low cardiac index "(CI) both are in combination used to in the process of diagnosing of the Cardiogenic shock. In addition to "elevated pulmonary capillary occlusion pressure (PCOP)" and "an increase in systemic vascular resistance index" [11]. On the other hand, evidence showed that systematic inflammatory response initiated by the release and of cytokines, in addition to the inducible nitric oxide and inappropriate vasodilation may play important role [12]. PDEIs also have inotropic and additional vasoligating actions [13]. Furthermore, some research show that PDEIs improve myocardial relaxation and the coronary arteries perfusion [14]. In addition to that levosimendan in its therapeutic dose can work as novel calcium sensitizer and dilator which results in decrease myocardial oxygen demand through its positive inotropic effect [15,16]. Also, vasodilatations that work on triphosphate dependent potassium channels can improve the myocardial perfusion which is also can also be maintained more longer as result of the "the presence of a pharmacologically active metabolite with a prolonged elimination half-life" [17-19]. Furthermore, studies show Levosimendan has good outcomes with decompensated heart failure patients [20-22].

Although there is improvement in the therapeutic and interventional procedure the mortality rate associated with the acute myocardial infarction complicated by cardiogenic shock remains high [23,24].

On the other hand, one of the mechanical hemodynamic mechanical hemodynamic support device is Intra-aortic balloon pump (IABP) which is wok to improves diastolic blood pressure and reduce myocardial muscles oxygen consumption which lead eventually to improve the cardiac output [25-27]. American and European guidelines "recently downgraded IABP use for cardiogenic shock from a class I to a class IIa and IIb recommendation" [28,29]. However, the registry data showed some degrees of insufficiency [27]. Based in the review of the current publication and trails "only one sufficiently large randomized trial of intra-aortic counter pulsation in cardiogenic shock secondary to myocardial infarction (IABP-SHOCK II trial) has been done" which showed "Survival benefit with IABP" [30]. Although long term follow up showed "significant mortality benefit at extended follow-up" [31-33].

As there are many literature and researches about the treatment of cardiogenic shock complicating acute myocardial infraction, including Re-vascularization, Intra-aortic balloon pump, yet evidence of their efficacy is not well established, aiming to clarify What is the types of current available Treatment of Cardiogenic shock complicating acute myocardial infraction.

## Materials and Methods

The present review was conducted November 2018 in accordance with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) declaration standards for systematic reviews. We reviewed all the topics on treatment of cardiogenic shock complicating acute myocardial infraction, such as levosimendan, a novel in dilator, revascularization, intra-aortic balloon pump (IABP).

To achieve this goal, we searched Medline, Embase, Web of Science, Science Direct, and Google Scholar for, researches, review articles and reports, published over the past 15 years.

Our search was completed without language restrictions. Then we extracted data on study year, study design, and key outcome on diabetes. The selected studies were summarized and unreproducible studies were excluded. Selected data is shown in the table 1.

| Author and year | Sample | Management | Key point |
|---|---|---|---|
| Joerg T. 2008 [34] | Thirty-two patients with refractory cardiogenic shock. | Levosimendan, a novel inodilator | levosimendan would seem to be superior to enoximone as add-on therapy for patients with severe and refractory CS complicating AMI. |
| Judith S. 2006 [35] | 302 patients from April 1993 through November 1998 with acute myocardial infarction complicated by cardiogenic shock | Revascularization | Early revascularization should be used for patients with acute MI complicated by cardiogenic shock due to left ventricular failure. |
| Holger T. 2013 [36] | 595 patients completing 12 month follow-up | intra-aortic balloon pump (IABP) | IABP support did not reduce 12-month mortality in patients with cardiogenic shock complicating myocardial infarction undergoing early revascularisation. Quality of life was good for survivors of cardiogenic shock at 6 and 12 months. |

### Inclusion criteria

Inclusion criteria were treatment of cardiogenic shock complicating acute myocardial infraction medical, surgical.

### Exclusion criteria

Irrelevant articles [not related to the aim of this review and articles that did not meet the inclusion criteria in this review.

### Data extraction and analysis

Information relating to each of the systematic review question elements was extracted from the studies and collated in qualitative tables. Direct analysis of the studies of treatment of cardiogenic shock complicating acute myocardial infraction

## Results and Discussion

Randomized study of total number of 32 patients with refractory Cardiogenic shock by using levosimendan in addition to their current therapy showed no significant change or difference between the two groups measurements, all the cases went through Successful revascularization. “87% (14 of 16 patients) of both groups treated with percutaneous coronary intervention, also norepinephrine had been administered at the point of randomization after all of the patients received a dose of dobutamine. median duration of use of 5.1 [3.8 - 6.6] days of enoximone infusion started at 3.5 [3.0 - 4.0] g/kg/min” [34].

from in April 1993 till November 1998 Hochman JS and his colleagues conducted international randomized clinical trial (IRCT) involved 302 patients with acute myocardial infarction complicated by CS “(mean [SD] age at randomization, 66 [11] years); long-term follow-up of vital status, conducted annually until 2005, ranged from 1 to 11 years (median for survivors, 6 years)”, the Study showed at the first 1st year “The group difference in survival of 13 absolute percentage points at 1 year favoring those assigned to early revascularization remained stable at 3 and 6 years (13.1% and 13.2%, respectively; hazard ratio [HR], 0.74; 95% confidence interval [CI], 0.57 - 0.97; log-rank P = .03)” after 6 years the groups of the early revascularization and initial medical intervention, their Survival rate respectively were 32.8% and 19.6%. On the other hand, 143 who survived patients the observed survival difference also was (HR, 0.59; 95% CI, 0.36-

0.95; P = .03) "The 6-year survival rates for the hospital survivors were 62.4% vs 44.4% for the early revascularization and initial medical stabilization groups, respectively, with annualized death rates of 8.3% vs 14.3% and, for the 1-year survivors, 8.0% vs 10.7%" [35].

In other Study 600 patients were assigned to IABP (n = 301) or control (n = 299) from June 16, 2009 to March 3, 2012 "Of 595 patients completing 12-month follow-up, 155 (52%) of 299 patients in the IABP group and 152 (51%) of 296 patients in the control group had died (relative risk [RR] 1.01, 95% CI 0.86 - 1.18, p = 0.91)" reinfarction show no significant difference (RR 2.60, 95% CI 0.95 - 7.10, p = 0.05), recurrent revascularisation (0.91, 0.58 - 1.41, p = 0.77), or stroke (1.50, 0.25 - 8.84, p = 1.00). For the two groups of the study the "quality-of-life measures including mobility, self-care, usual activities, pain or discomfort, and anxiety or depression" had been monitored so far no significant difference between study groups [36].

Significant improvement and decrease in the mortality rate had been showed in the 30 day of the follow up for the patient with refractory Cardiogenic shock complicating acute myocardial infraction when they are treated with levosimendan.

In addition to their current therapy, most of the death was from cardiac origin., on the other hand, multiple organ failure used to happen with enoximone group. Levosimendan has tendency to improve the "parameters of cardiac power index, CI, left ventricular stroke work index and Svo2 during the first 12 hrs, reaching significance for Svo2 only". The study covers the short of evidence about the superiority of phosphodiesterase-III inhibitors vs Levosimendan [34].

11 years randomized trial showed significant 6-year of survival which appear in the regular follow up after early revascularization of patients with Cardiogenic shock complicating acute myocardial infraction which showed positive outcome "130 lives saved per 1000 patients treated, or 8 patients needed to be treated to save 1 life" at the first year of the study the survival rate was the same "with an annualized mortality rate of 8.0 vs10.7deaths per 100 patient-years for early revascularization compared with initial medical stabilization" [35].

Randomized trial show Intra-aortic balloon pump (IABP) slight improve the quality of the life arranged from moderate to good in the patients with cardiogenic shock complicating acute myocardial infarction. Otherwise it doesn't show any ability to improve the survival rate in the short term follow up of 6 and 12 months). "Despite early revascularization and optimum medical therapy in both groups, mortality was still slightly higher than 50% at 1-year follow-up" [36].

## Conclusion

On the basis of findings and results this review found levosimendan, a novel in dilator, revascularization, intra-aortic balloon pump (IABP) are the most common treatment of cardiogenic shock complicating acute myocardial infraction. However, currently, there is only limited evidence for any of the above treatments.

## Conflict of Interest

The authors of this article hasn't receive and support for this work and it was completely self-funded.

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