# Percutaneous Coronary Intervention in Acute Myocardial Infarction with Cardiogenic Shock: Immediate and Late Outcomes

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**Abstract**

**Background :** Acute myocardial infarction (AMI) with cardiogenic shock carries a high mortality rate. Early revascularization shows better results than conservative medical treatment.

**Objective :** To determine short and long term results of patients with cardiogenic shock from AMI who underwent percutaneous coronary intervention (PCI).

**Methods :** Patients were identified from the PCI registry from 1993 to 1999. Follow-up data were collected from medical records and/or phone calls.

**Results :** From 1993 to 1999, there were 1211 PCI procedures performed at King Chulalongkorn Memorial Hospital. Seventeen of these cases (M9, F8) had cardiogenic shock. Mean age was 59 ± 14 yrs. Fourteen patients had AMI. The other 3 cases developed shock more than 24 hours after AMI. Primary PCI was done in 11 cases. Thirteen patients (76.5%) needed intra-aortic balloon pump support. Average peak CPK and CK-MB were 5393 and 580 u/l, respectively. Five patients (29.4%) died in hospital, 3 of whom died on the first day due to pump failure. Twelve patients were followed for a mean duration of 412 days (range 12 - 1,464). One patient died 6 months after PTCA because of in-stent restenosis of the left main coronary artery.

**Conclusion :** AMI with cardiogenic shock has a high mortality rate. However, in this group of patients who had early revascularization by PCI, mortality seemed to be lower than previously reported. If PCI is available, the procedure should be offered for this subset of AMI patients.

**Key word :** Acute Myocardial Infarction, Cardiogenic Shock, Percuteneous Coronary Intervention

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Cardiogenic shock complicating acute myocardial infarction (MI) is a most serious condition with a 70-80 per cent mortality rate[1-2]. Many non-randomized studies have shown markedly improved survival rate among patients who underwent revascularization for cardiogenic shock[3-14]. A recent randomized trial reported by the SHOCK investigators[15] showed early revascularization either by percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) had a better outcome than conservative medical treatment.

In Thailand, the mortality rate from cardiogenic shock complicated by acute MI is about 70-80 per cent[16,17]. Until now, there has been no available data in the subgroup of patients who underwent coronary revascularization. This study was undertaken to determine the initial and long-term outcomes of patients who underwent PCI for acute MI with cardiogenic shock in our center.

## Methods

All patients who underwent PCI and were in cardiogenic shock from January 1993 to December 1999 were enrolled. The in-hospital data were collected from medical admission records, OPD cards and PCI registry forms. Follow-up data were obtained from medical admission records, OPD cards, telephone calls or by mail. The criteria for diagnosis of cardiogenic shock were systolic blood pressure less than 90 mmHg or requirement of inotropic/vasopressor drug or intraaortic balloon pump (IABP) to maintain hemodynamic stability with clinical signs of hypoperfusion stage such as cold extremities or urine output less than 30 cc/hour. Pulmonary artery catheter was not necessary in all of the cases but if the patient required a Swan-Ganz catheter to monitor pulmonary wedge pressure, it should be more than 15 mmHg.

### Statistical analysis

Categorical variables were determined in number and percentage. Continuous variables were determined in mean ± SD. These were compared with those from the SHOCK trial but the statistical significance was not determined. Kaplan-Meier survival analysis was used to analyze the cumulative survival by using Statview, McIntoch version 4.0.

## RESULTS

Seventeen of 1,211 (1.4%) patients who underwent PCI from January 1993 to December 1999 were in cardiogenic shock. Fourteen cases had PCI

**Table 1. Baseline characteristics of the patients compared with the SHOCK trial.**

| Characteristics | This study (n=17) | SHOCK-trial |
|---|---|---|
| Age (y) | 58.8 ± 13.5 | 65.8 ± 10.0 |
| Gender : Male (%) | 52.9 | 63.2 |
| Smoking (%) | 47.1 | 52.6 |
| Hypertension (%) | 41.2 | 49.0 |
| Dyslipidemia (%) | 47.1 | NA |
| Previous myocardial infarction (%) | 29.4 | 29.6 |
| Left ventricular ejection fraction (%) | 39.3 ± 7.3 | 29.1 ± 10.6 |
| Anterior wall infarction (%) | 58.8 | 63.6 |
| Infarct-related artery | | NA |
| Left anterior descending (%) | 52.9 | |
| Right coronary (%) | 41.2 | |
| Leftmain (%) | 5.9 | |
| Number of diseased vessel | | |
| 1-vessel (%) | 47.1 | 14.0 |
| 2-vessel (%) | 23.5 | 21.7 |
| 3-vessel (%) | 29.4 | 64.3 |
| Peak cardiac enzyme | | |
| CK (μ/l) | 5,393 (1,282-1,5190) | 3,068 (1,322-6,350) |
| CKMB (μ/l) | 473 (158-1,679) | NA |
| CPR prior angioplasty (%) | 41.2 | 32.7 |

NA - not available, CK - creatine kinase, CPR - cardiopulmonary resuscitation

**Table 2. Hemodynamic status of the patients compared with SHOCK.**

| Characteristics | Our study (n=17) | SHOCK-trial |
|---|---|---|
| Systolic blood pressure (mmHg) | 81.5 ± 8.5 | 89.0 ± 22.8 |
| Heart rate (beat/min) | 110 ± 18 | 103 ± 22 |
| Pulmonary wedge pressure (mmHg) | 21.0 ± 4.6 | 24. 2 ± 7.1 |
| Cardiac index (l/min/m2) | 1.9 ± 0.7 | 1.8 ± 0.7 |
| Intra-aortic balloon pump used (%) | 76.5 | 86.2 |
| Inotropic (%) | 100 | 99.3 |

**Table 3. Result of the percutaneous coronary intervention of the patients who had cardiogenic shock.**

| | N = 17 (%) |
|---|---|
| Pain duration* (min) | 382 ± 498 |
| Door to balloon time^ (min) | 89.3 ± 53.9 |
| Angiographic success (%) | 15 (88.2) |
| Number of stent implantation (%) | 9 (52.9) |
| Fluoroscopy time (min) | 13.6 ± 8.3 |
| Procedural time (min) | 71.2 ± 27.8 |

* Pain duration - onset of chest pain to emergency department
^ Door to balloon time - the time from emergency department to first balloon dilatation
(The medain time to randomization in SHOCK trial was 11 hours)

**Table 4. In-hospital adverse cardiac events.**

| | N = 17 | % |
|---|---|---|
| Death | 5 | 29.4 |
| Re-angioplasty (sub-acute stent thrombosis) | 1 | 5.9 |
| Re-infarction | 1 | 5.9 |
| Emergency coronary artery bypass graft | 3 | 17.6 |
| Major adverse cardiac events | 7 | 41.2 |

performed within 24 hours of onset of chest pain and were classified as acute MI indication. Eleven of these 14 were performed as primary PCI and 3 cases were sent to PCI because of thrombolytic failure. The remaining 3 of 17 patients had developed cardiogenic shock more than 24 hours after the onset of chest pain. Table 1 shows baseline characteristics of the patients compared with the SHOCK trial. From our data, the patients were younger (58.8 ± 13.5 *versus* 65.8 ± 10.0 year) and less likely to be male (52.9% *versus* 63.2%). There was little difference in major coronary risk factors such as smoking, hypertension, dyslipidemia and diabetes. Left ventricular ejection fraction (EF) was higher in our study than the SHOCK trial, however, the cardiac index was the same. About 60 per cent of the patients had anterior wall MI and one case had left main artery occlusion. Almost 50 per cent of the cases had one vessel disease and 29.4 per cent had triple vessel disease (TVD) which differs from the SHOCK trial, in which most of the patients had TVD. Forty per cent of the cases needed cardiopulmonary resuscitation (CRP) prior to PCI. Hemodynamic data are shown in Table 2, 76 per cent of patients required IABP to support hemodynamic and all of the patients needed inotropic or vasopressor medications. Regarding the results (Table 3), the duration of onset of chest pain before admission was 382 ± 498 minutes and door to balloon time was 89.3 ± 53.9 minutes. Fifteen of 17 (88.2%) had angiographic success with TIMI 3 flow. The other 2 cases developed no-reflow and subsequently died on the day of admission. A stent was implanted in more than 50 per cent. Only one case (5.9%) developed recurrent MI from subacute stent thrombosis (Table 4) and underwent successful revacularization by PCI. Three patients required emergency CABG because they had TVD and couldn't maintain good hemodynamic status after PCI. Two of them died during hospitalization. Overall in-hospital mortality was 29.4 per cent. During the follow-up period (mean 412 ± 436 days, range from 12 to 1464), one patient died 6 months later while waiting for CABG because of left main in-stent restenosis. The 4-year mortality was 42.6 per cent. One patient had surgery for anuerysmectomy 4 months later due to intractable congestive heart failure (CHF) and ventricular tachycardia. This patient was lost to follow-up after discharge from hospital. One patient returned with unstable angina because of restenosis in the right coronary artery and required re-intervention with PCI. Fig. 1 shows the Kaplan-Meier cumulative sur-

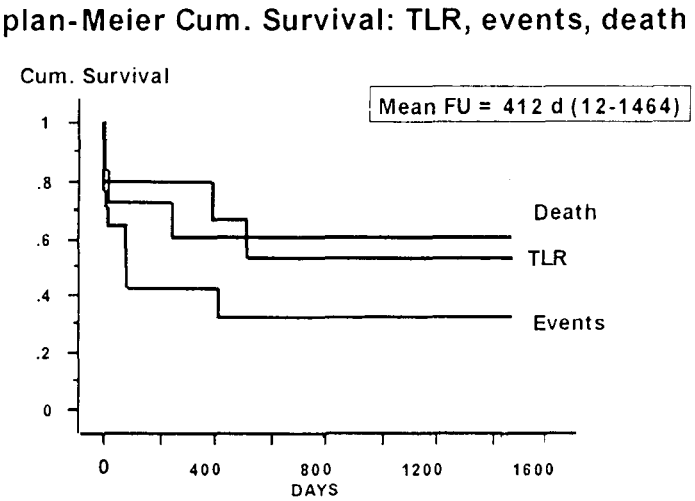


**Fig. 1. Kaplan-Meier cumulative survival analysis for target lesion revascularization, major adverse cardiac events and death.**

vival plot for death, target lesion revascularization (TLR) and major cardiac events (including death, TLR, re-MI, CABG, unstable angina or CHF requiring admission).

## DISCUSSION

This is the first report of PCI in acute MI complicated with cardiogenic shock in Thailand. The patients still had a high mortality rate even after receiving coronary revascularization. However, the outcomes seem to be better than those reported in the SHOCK trial[15]. The patients in our study were similar to those in the SHOCK trial although there were some characteristic baseline differences. This group had some good prognostic indicators such as younger age, fewer triple vessel disease patients and higher left ventricular EF; however, peak creatinine phosphokinase was higher in this study as well as heart rate and per cent of patients who had CPR prior to PCI. Regarding the duration of pain before admission, the average time in our study was shorter (382 ± 498 minutes) than the pain duration from MI to randomization in the SHOCK trial (median time was 11 hours). Perhaps this is another reason why in-hospital mortality was not excessively high. Five patients died during hospitalization and 3 of them died on the day of admission. During the follow-up period, only one patient died due to in-stent restenosis in the left main coronary artery while waiting for urgent CABG. Another case underwent LV aneurysmectomy because of intractable CHF and ventricular tachycardia after 4 months. This indicates that the long-term outcome in this subgroup of patients is acceptable. This study was not designed to determine prognostic indicators, because of the small sample size.

## SUMMARY

The mortality rate in acute MI complicated with cardiogenic shock is high but can be improved with emergency revascularization, particularly with PCI. The long-term outcome is acceptable. If PCI is available, it should be offered to patients who present with acute MI with cardiogenic shock.

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# ผลระยะสั้นและระยะยาวของการทำบอลลูนขยายหลอดเลือดหัวใจในผู้ป่วยกล้ามเนื้อหัวใจตายเฉียบพลันที่มีภาวะช็อก

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**ภูมิหลัง** : ภาวะกล้ามเนื้อหัวใจตายเฉียบพลันที่มีอาการช็อกเป็นภาวะที่มีอัตราตายสูง การรักษาโดยรีบด่วนไม่ว่าจะด้วยการทำบอลลูนขยายหลอดเลือดหรือการทำผ่าตัดต่อเส้นเลือดหัวใจได้ผลดีกว่าการให้การรักษาแบบประคับประคองด้วยยา

**วัตถุประสงค์** : เพื่อที่จะศึกษาผลการรักษาระยะสั้นและระยะยาวของผู้ป่วยที่มาด้วยภาวะช็อกจากกล้ามเนื้อหัวใจตายเฉียบพลัน ซึ่งได้รับการรักษาด้วยการทำบอลลูนขยายหลอดเลือดหัวใจ

**วิธีการ** : เลือกผู้ป่วยที่เกิดภาวะช็อกที่ได้รับการรักษาด้วยการทำบอลลูนขยายหลอดเลือดหัวใจตั้งแต่ปี พ.ศ. 2536 ถึง 2542 ข้อมูลภายหลังการรักษาได้จากประวัติผู้ป่วยและการโทรศัพท์ถามอาการ

**ผลการรักษา** : ในช่วงปี พ.ศ. 2536 ถึง 2542 ผู้ป่วย 1,211 รายได้รับการรักษาด้วยการทำบอลลูนขยายหลอดเลือดหัวใจ พบว่า 17 ราย (ชาย 9, หญิง 8) อยู่ในภาวะช็อกจากกล้ามเนื้อหัวใจตาย อายุเฉลี่ยเท่ากับ 59 $\pm$ 14 ปี 14 รายเกิดภาวะช็อกใน 24 ชั่วโมงและ 3 รายเกิดช็อกภายหลัง 24 ชั่วโมงของการเกิดกล้ามเนื้อหัวใจตายเฉียบพลัน 11 รายได้รับการทำ primary percutaneous coronary angioplasty (การขยายบอลลูนภายใน 24 ชั่วโมงของการเกิดกล้ามเนื้อหัวใจตายเฉียบพลันโดยไม่ได้รับยาละลายลิ่มเลือดมาก่อน) ผู้ป่วย 13 ราย (76.5%) จำเป็นต้องใช้ intra-aortic balloon pump ค่าสูงสุดของ CK และ CKMB เท่ากับ 5393 และ 580 u/l ตามลำดับ ผู้ป่วยเสียชีวิตในโรงพยาบาล 5 ราย (29.4%) 3 รายเป็นผลมาจากการทำงานของหัวใจล้มเหลว ผู้ป่วย 12 รายได้รับการติดตามการรักษาต่อไป โดยระยะเวลาเฉลี่ยของการติดตามเท่ากับ 412 วัน (12-1,464 วัน) ผู้ป่วย 1 รายเสียชีวิต 6 เดือนหลังทำบอลลูนขยายหลอดเลือดซึ่งเป็นผลจากการตีบซ้ำของเส้นเลือดที่ใส่ขดลวดในเส้นเลือด leftmain

**บทสรุป** : ภาวะช็อกจากกล้ามเนื้อหัวใจตายเฉียบพลันมีอัตราตายสูง การรีบให้การรักษาด้วยการทำบอลลูนขยายหลอดเลือดหัวใจในระยะแรก สามารถที่จะลดอัตราตายได้และควรจะทำให้ผู้ป่วยทุกรายที่อยู่ในสถานที่ที่สามารถทำได้หรือสามารถส่งต่อผู้ป่วยมายังสถานที่ที่ทำได้

**คำสำคัญ** : กล้ามเนื้อหัวใจตายเฉียบพลัน, การทำบอลลูนขยายหลอดเลือด, ภาวะช็อคจากหัวใจ

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