use. In the future, the hybrid approach may become a treatment option in the management of severe IMR and coronary artery disease. Thus, the complexity of a major procedure may be lowered in some selected no-option patients.

Conclusion

This report shows that the hybrid approach with MitraClip® and CABG could be a safe, feasible, and effective alternative therapeutic strategy in patients with concomitant severe IMR and coronary artery disease.

Video 1. Coronary angiography shows a total occlusion of the proximal left anterior descending artery
Video 2. Coronary angiography shows retrograde filling of the total occluded proximal left anterior descending artery from the right coronary artery with a collateral circulation
Video 3. Transesophageal echocardiography shows severe mitral regurgitation from the middle segments of both leaflets (A2 and P2 segments) in the central four-chamber view
Video 4. Transesophageal echocardiography demonstrates severe mitral regurgitation from the middle segments of both leaflets (A2 and P2 segments) in the left ventricular outflow tract view
Video 5. After two clips were implanted between the central scallops, postprocedure transesophageal echocardiographic evaluation shows resolution of the severe mitral regurgitation in left ventricular outflow tract view

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Available Online Date: 22.05.2015

DOI:10.5152/akd.2015.6157

Treatment of left main shock syndrome with percutaneous coronary intervention in the absence of an advanced left ventricular assist device or ECMO

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Introduction

Acute total occlusion of the unprotected left main coronary artery (LM) results in cardiogenic shock, or left main shock syndrome (LMSS), in the majority of affected patients (1). The prognosis of the subset of patients with LMSS and complete occlusion is dire, with up to 100% mortality (2).

In this paper, three patients with LMSS who underwent percutaneous coronary intervention (PCI) alone or PCI with the implementation of IABP were included. We have discussed how to approach a patient with LMSS on diagnosis and transfer and its treatment in the absence of advanced LV assist devices or ECMO.

Case Reports

Case 1

A patient with a direct crossover LM-to-LAD stent had a sudden onset of chest pain at our outpatient clinic. His ECG showed ST-segment elevation of D1 and aVL (Fig. 1). We observed an acute complete occlusion of LM, which resulted from subacute thrombosis of the crossover LM-to-LAD stent. Ventricular fibrillation (VF) occurred during the introduction of a 2.0×20-mm catheter balloon (Invader, Alvi Medica Co). Because the balloon catheter was already at the tip of the JL4 guiding catheter, we first inflated the balloon at 8 atm. Then, we attempted to convert VF and observed that it already spontaneously recovered to sinus rhythm after balloon dilatation. Later, a 3.5×15-mm bare metal stent (BMS, Integrity, Medtronic Co.) was inserted to the proximal portion of the previous stent with a final kissing balloon (2.0×20 mm and 3.5×20 mm; Invader, Alvi Medica Co) in LAD and the left circumflex artery (LCx). During the procedure, three VFs and one pulseless ventricular tachycardia (VT) were converted to sinus rhythm via a defibril-

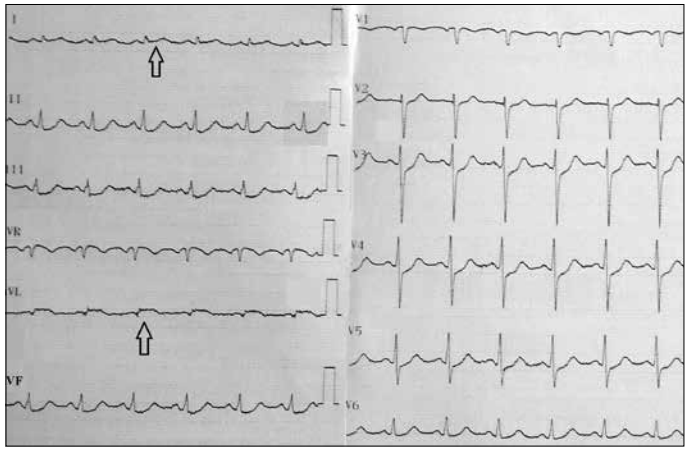

Figure 1. ECG of the first case with LMSS showed an ST-segment elevation in D1 and aVL, indicating only a high lateral myocardial infarction. LMSS-left main shock syndrome

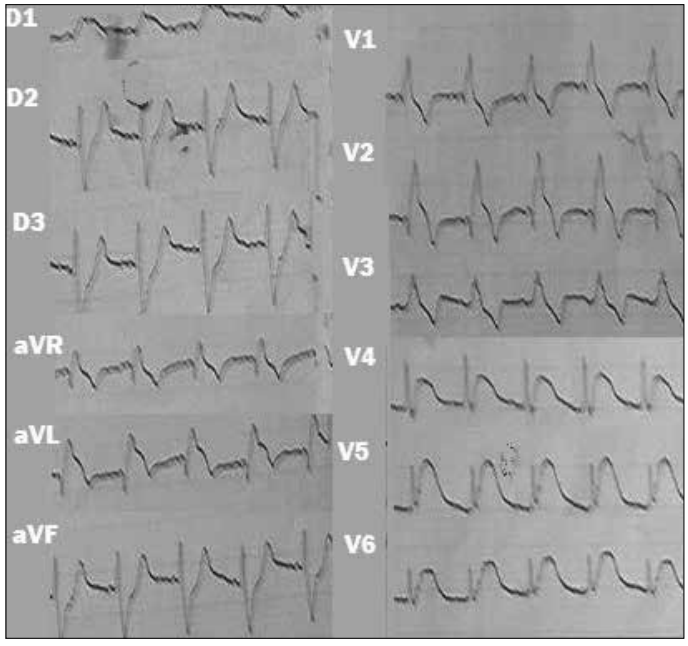

Figure 2. ECG of the second case with LMSS indicated an anterolateral infarction due to a spasm and thrombus in LM, probably associated with Bonsai abuse
LM - left main; LMSS - left main shock syndrome

lator. The first VF (before predilatation) and one VT (after PCI) were spontaneously converted to sinus rhythm. There was no problem for four months after follow-up.

Case 2

A 19-year-old man was admitted to the emergency department with complaints of nausea, vomiting, and confusion for an hour. ECG showed an anterolateral infarction (Fig. 2). The history of smoking and Bonsai (synthetic cannabinoids) abuse was noted. LM was totally occluded. The symptom-onset-to-balloon time was more than 1 h. After predilatation with a 3.0×20-mm balloon (Invader, Alvi Medica Co), the implantation of a crossover LM-to-LAD stent with a 4.0×20-mm BMS (CC Flex, Euatech AG) resulted in TIMI 3 perfusion of LAD (Fig. 3). VF occurred and was successfully defibrillated. After the introduction of IABP, he was transferred to the coronary care unit. He died despite all efforts.

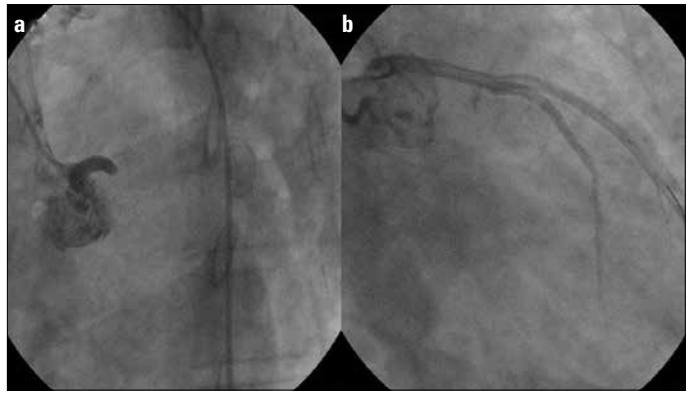

Figure 3. a, b. A total occlusion of LM due to a spasm and thrombosis (a) resulting in LMSS was treated with PCI and implementation of IABP after the procedure (b)
IABP - intraaortic balloon pump; LM - left main; LMSS - left main shock syndrome; PCI - percutaneous coronary intervention

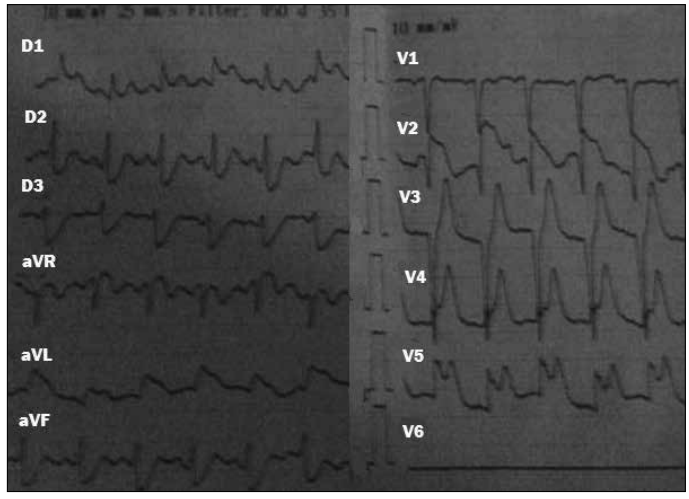

Figure 4. ECG of the third case with LMSS indicated an anterolateral infarction
LMSS - left main shock syndrome

Case 3

A 74-year-old man was admitted to a medical center with syncope that developed an hour before admission. His ECG (Fig. 4) indicated an anterolateral myocardial infarction. There was a thrombus in the ostium of LM. The symptom-onset-to-balloon time was 3 h. A 4.0×12-mm BMS (Liberte, Boston Scientific) was directly implanted (Fig. 5). The deployment of a stent to LCx was unsuccessful. Four VFs were successfully defibrillated during this procedure. He died despite the implementation of IABP and intensive medical care.

Discussion

LMSS has an extremely poor prognosis with common occurrences of poor final flow, pump failure, and multiorgan failure. The dominance of RCA, which is the only open artery in LMSS, extent of LM perfusion (TIMI 0-3), and symptom-onset-to-balloon time probably determine the longevity of time period to develop and sustain LMSS. This invaluable time is usually wasted in LMSS during diagnosis and transfer. ECG showed a high lateral infarction in the first case and anterolateral infarction in the other two cases. The diagnosis of LM involvement can only be made on angiography.

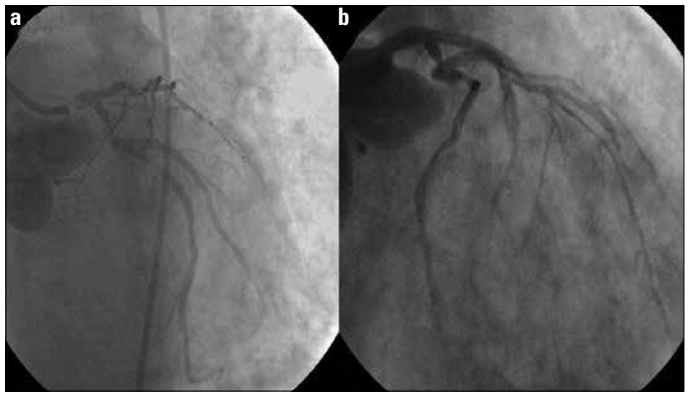

Figure 5. a, b. On coronary angiography, both a massive thrombus occluding to LM and a 90% stenosis of LCx were shown in the third case with LMSS (a). IABP was introduced after PCI (b)
LCx - left circumflex artery; LM - left main; LMSS - left main shock syndrome; PCI - percutaneous coronary intervention

A prompt application of stenting results in acceptable mortality and morbidity rates (1-5). Hata et al. (6) suggest that an immediate PCI with mechanical supports is required prior to coronary artery bypass surgery for the survival of patients with LMSS. Unfortunately, percutaneous assist devices or ECMO are not widely available (7-9). The first patient survived after PCI alone, probably because of the less than 15-min symptom-onset-to-balloon time, which was 75 and 180 min in the other two cases respectively (10). A late successful reperfusion of LM was not sufficient to recover the bad outcome despite introduction of an IABP.

Conclusion

Because ECG is not a reliable tool, an anterolateral infarction should be treated as LMSS unless it is disregarded on coronary angiography. Despite a proper PCI and implementation of IABP, LMSS cannot easily recover and may deteriorate faster. We believe that a part time introduction of advanced LV assist devices or ECMO to support a failing heart contributes to poor prognosis in LMSS. The rapid restoration of flow with a symptom-onset-to-balloon time less than 15 min may be a definitive intervention with optional implementation of IABP for an inpatient.

Video 1. A definitive PCI was performed with final kissing at the end of the procedure to treat subacute thrombosis of a crossover LM-to-LAD stent.
LAD - left anterior descending artery; LM - left main; LMSS - left main shock syndrome

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Available Online Date: 22.05.2015

DOI:10.5152/akd.2015.6195