Cardiopulmonary Arrest Caused by Diffuse Coronary Artery Spasm Due to Balloon Dilatation: Case Report

Balon Dilatasyona Bağlı Gelişen Yaygın Koroner Arter Spazmının Neden Olduğu Kardiyopulmoner Arrest Olgusu

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For the video/videos of the article:

ABSTRACT The coronary vasospasm is a frequent event during percutaneous coronary intervention. It can be caused by catheter, guidewire insertion, balloon dilatation or stent deployment. Coronary vasospasm due to percutaneous coronary intervention can be easily treated with intracoronary nitroglycerin. Coronary vasospasm refractory to intracoronary nitroglycerin is very rare, but can be catastrophic when it does ocur. We report the case of a patient in whom diffuse coronary spasm of the entire left coronary system (distal segment of the left main coronary artery, left anterior descending artery with diagonal and septal branches, intermedier artery and left circumflex artery) during coronary artery stenting of the left anterior descending artery . In this case, the coronary vasospasm was refractory to intracoronary nitroglycerin and resulted in cardiopulmonary arrest. The patient was successfully resuscitated and treated by administered of intracoronary verapamil and implantation of a bare-metal stent.

Key Words: Coronary vasospasm; nitroglycerin; heart arrest

ÖZET Koroner arter spazmı perkütan koroner girişimler esnasında sık gözlenen bir olaydır. Stent yerleştirilmesi, balon ile genişletme, kılavuz telin ilerletilmesi ve kateterin yerleştirilmesi spazma neden olabilir. Perkütan koroner girişime bağlı gelişen koroner arter spazmı intrakoroner nitrogliserin uygulaması ile kolaylıkla tedavi edilir. İntrakoroner nitrogliserin uygulamasına cevap vermeyen koroner arter spazmı çok nadirdir fakat geliştiği zaman sonuç yıkıcı olabilir. Biz bu olguda sol ön inen arterin stentlenmesi esnasında gelişen ve sol koroner sistemi bütünüyle (sol ana koroner arterin distal segmenti, septal ve diagonal dallarıyla birlikte sol ön inen arter, intermedier arter ve sol sirkümfleks arter) etkileyen yaygın koroner arter spazmını sunuyoruz. Bu olguda koroner arter spazmı intrakoroner nitrogliserin uygulamasına yanıt vermedi ve hastada kardiyopulmoner arrest gelişti. Başarılı bir şekilde resüsitasyon uygulanan hasta intrakoroner verapamil uygulaması ve stent yerleştirilmesi ile tedavi edildi.

Anahtar Kelimeler: Koroner vazospazmı; nitrogliserin; kalp durması

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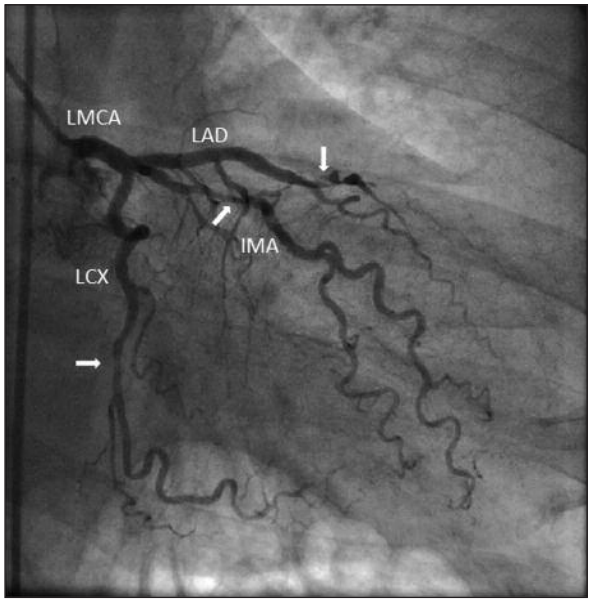
The coronary vasospasm caused by mechanical stimuli in the target vessel is a frequent event during percutaneous coronary intervention (PCI). It usually occurs at the site of the treated lesions or in the distal vessel and relieves by intracoronary injection of nitroglycerin. Coronary vasospasm refractory to intracoronary nitroglycerin is very rare, but can be catastrophic when it does occur, with the prolonged occlusion of a major coronary artery inducing a fatal arrhythmia, hemodynamic collapse or cardiogenic shock.



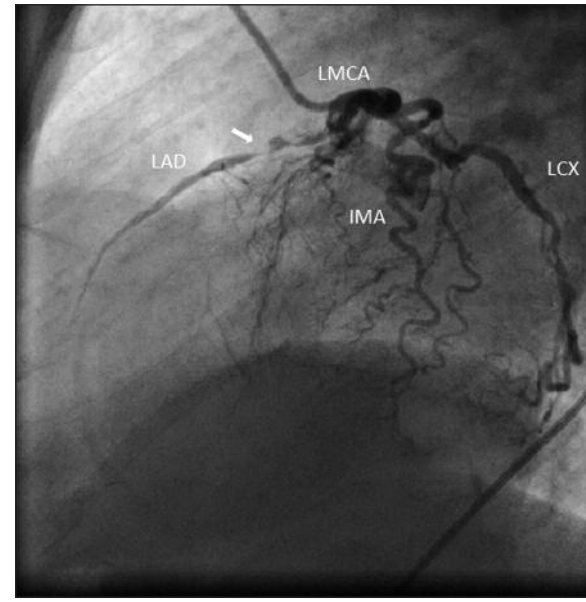


FIGURE 1-2: Coronary angiography showed critical lesion located in the proximal segment of the LAD in right caudal and left lateral views.

CASE REPORT

In November 2008, a 51-years-old man with a past medical history of hypertension and hyperlipidemia was admitted to our clinic with complaint of retrosternal chest pain on exertion. He was experienced an anterior myocardial infarction two weeks ago. Initial electrocardiogram demonstrated pathological Q waves and biphasic T waves in precordial leads. On physical examination, blood pressure was 150/100 mmHg, and heart rate was 74 beats/min regular. There were no abnormal findings on cardiac or other systemic examinations.

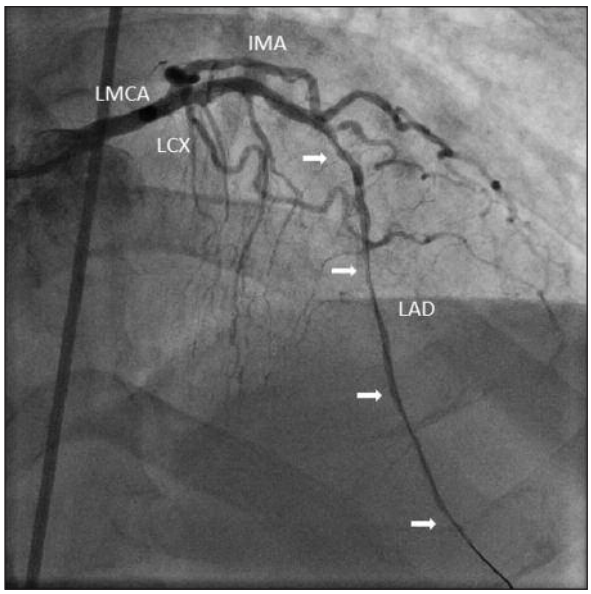


FIGURE 3: Coronary angiography after balloon dilatation showed severe spasm of the entire LAD including the first diagonal branch in AP cranial view.

The patient was put on aspirin 300 mg peroral, clopidogrel 600 mg peroral loading dose and also 10.000 U bolus intravenous heparin. Coronary angiography showed critical lesions located in the proximal segment of the LAD and in the origin of the first diagonal branch. The first diagonal branch had TIMI III flow, whereas the distal part of the LAD had TIMI I-II flow . There were 50% stenosis in the proximal segment of the intermedier artery (IMA) and 40% stenosis in the mid segment left circumflex artery (LCX) (Figure 1, 2, Video 1). The left main coronary artery (LMCA) and the right coronary artery was normal. With this findings coronary angioplasty for LAD was planned. The lesion in the proksimal segment of the LAD was predilated with a 2.5 x 15-mm balloon catheter. Selective angiography after balloon dilatation showed severe spasm of the entire LAD including the first diagonal branch (Figure 3, Video 2). The patient experienced severe chest pain, which correlated with ST elevation in the precordial ECG leads. The nitroglycerin was administered in to the left coronary system but vasospasm and symptoms were not relieved. The next selective angiogram

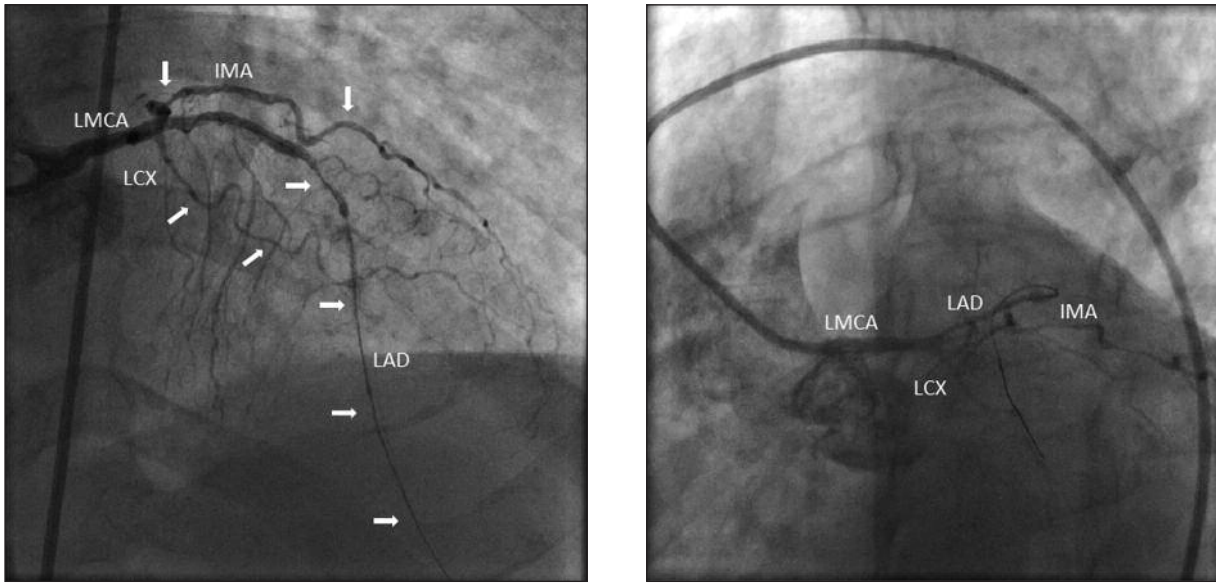


FIGURE 4-5: Coronary angiography after administered of the nitroglycerin showed very severe vasospasm of the entire left coronary system with almost complete obliteration of the vessel lumens in AP cranial and left caudal views.

after administered of the nitroglycerin showed very severe vasospasm of the entire left coronary system including the distal segment of the left main coronary artery, LAD with diagonal and septal branches, IMA and LCX with almost complete obliteration of the vessel lumens (Figure 4, 5, Video 3, 4). At this time his blood pressure and heart rate fell to 70/50 mmHg, 30 beats/min respectively. He was unconscious and his breathing was insufficient with oxygen saturation approximately 80% on room air. In a few seconds he developed ventricular fibrillation and cardiopulmonary arrest. The coronary angioplasty procudere was stopped and he was successfully resuscitated without apparent neurological sequelae by immediate defibrillation, mechanical ventilation, inotropic and chronotropic support including adrenaline, atropine and dopamine. After this procudere, hemodynamic status of the patient was recovered without intra-aortic balloon pump support. His blood pressure and heart rate rose to 120/70 mmHg, 110 beats/min respectively. After the intracoronary administration of verapamil, the vasospasm was completely resolved within a few minutes along with improvement of the symptoms. After that we continued to angioplasty procedure. The lesion in the proksimal segment of the LAD was treated by implantation of a 3.0x24 mm bare-metal stent (Figure 6, Video 5).

After the procedure, the patient's vital signs were stable and the chest pain disappeared. He was transferred to the general ward after careful observation in the intensive coronary care unit. Aspirin (100 mg), clopidogrel (75 mg), ramipril (5 mg), metoprolol (12.5 mg), isosorbide mononitrate (50

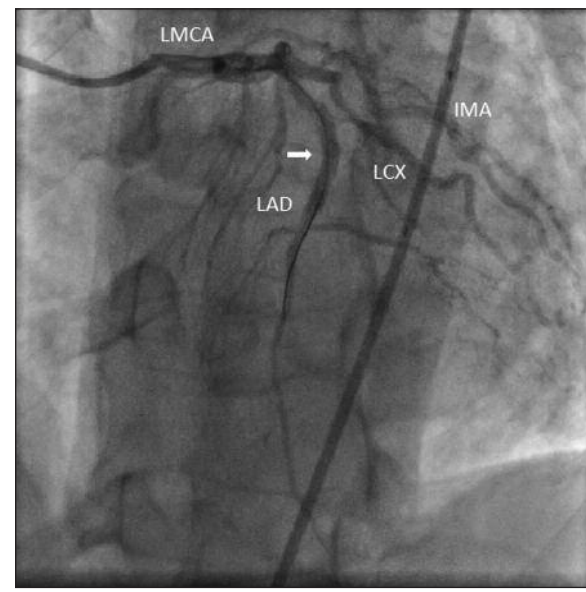


FIGURE 6: Coronary angiography after the administered of the werapamil and replacement of the stent showed resolution of the vasospasm.

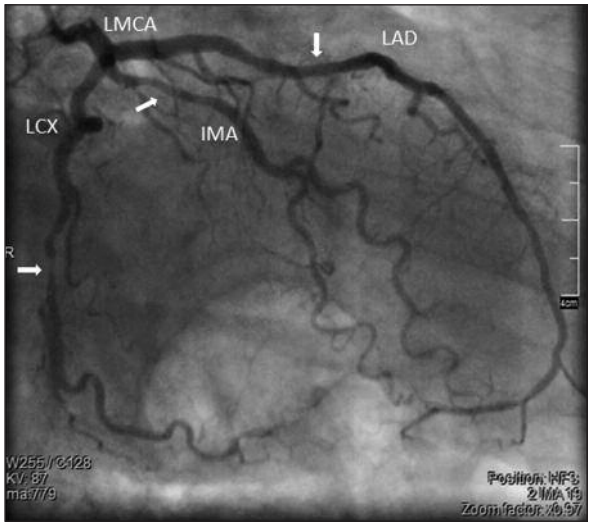


FIGURE 7: Coronary angiography in July 2010 showed patency of the stent in the proximal segment of the LAD.

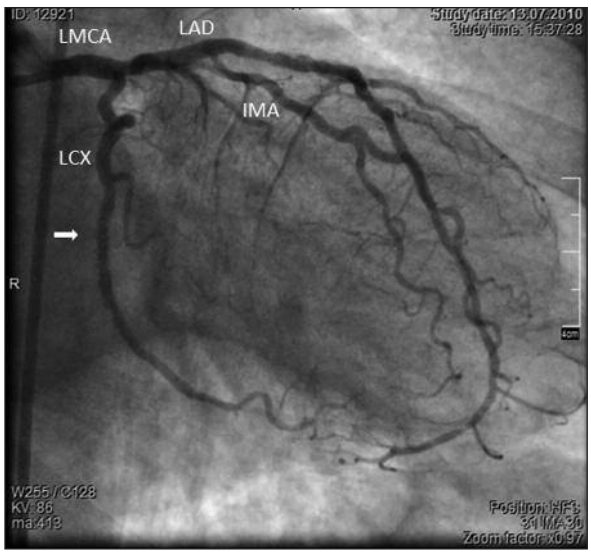


FIGURE 8: Coronary angiography in July 2010 showed patency of the stent in the proximal segment of the LAD.

mg) and atorvastatin (20 mg) were administered daily after stent implantation. Seven days after coronary angioplasty, the patient was well and discharged from the hospital.

In July 2010, he was admitted to our clinic with complaint of retrosternal chest pain on exertion for 3 weeks. Coronary angiography showed 80% stenosis in the the mid segment of the LCX. The stent in the proximal segment of the LAD was patent. (Figure 7, Video 6). The lesion in the mid segment of the LCX was treated by implantation of a 2.75 x 20-mm bare metal stent (Figure 8, Video 7). Two days after PCI, the patient was discharged from the hospital. Two years later, he had experienced no recurrence of symptoms.

DISCUSSION

Severe coronary vasospasm may occur during diagnostic or therapeutic procedures.[1] It can be caused by catheter, guidewire insertion, balloon dilatation or stent deployment. Coronary vasospasm due to coronary angioplasty can be easily treated with intracoronary nitroglycerin and cannot be considered a complication unless it is associated with clinical consequences. Coronary vasospasm refractory to intracoronary nitroglycerin is very rare, but can be catastrophic when it does occur as well as our case. In this situation calcium channel blockers can be used to relieve coronary vasospasm. In our patient we used to verapamil to relieve severe coronary vasospasm which is refractory to adminestered of intracoronary nitroglycerin. However, coronary vasospasm refractory to the treatment with nitroglycerin and calcium channel blockers is observed in some cases.[2-6] Alpha-1 blocking agents, magnesium, benzhexol hydrochloride, denopamine, and nicorandil have been reported as alternatives.

Coronary vasospasm during coronary angioplasty may appear at the ostium, at the lesion site, or anywhere in the vessel; it may be limited to a short segment or extend over a very long one and be associated with partial or total vessel occlusion.[7] Also the vasospasm of the remote coronary arteries during coronary angioplasty procedure has been reported.[8] In our case, the lesion in the proksimal segment of the LAD was pre-dilated with a balloon catheter but vasospasm was spreaded to the entire left coronary system including the distal segment of the LMCA, LAD, IMA and LCX with almost complete obliteration of the vessel lumens. The possibility that coronary stretching, caused by balloon dilatation, could trigger coronary spasm in remote coronary arteries has to be taken into consideration during coronary angioplasty.

Coronary vasospasm during coronary angioplasty can occur due to several procedural factors such as balloon dilatation. It can be easily treated with intracoronary nitroglycerin. The calcium channel blockers can be used if the vasospasm refractory to nitroglycerin. If the vasospasm is very severe, diffuse and refractory to treatment it can be caused to fatal consequences such as ventricular fibrillation or cardiogenic shock.

Consequently, the coronary vasospasm is a frequent event during PCI. To avoid catastrophic situations, essential medications and equipments must be provided during the procedure.

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