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Acute Myocardial Infarction Due to Left Main and Left Circumflex in Patient Have Damage to Triple Vessel Coronary Artery with Chronic Total Occlusion of the Right Coronary Artery: Coronary Artery Bypass Grafting or Percutaneous Coronary Intervention?

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KEYWORDS

myocardial infarction, PCI intervention, coronary artery CTO, coronary artery bypass grafting

ABSTRACT:

Objective: To study a case of myocardial infarction due to left main (Lm) and left circumflex (LCx) of the left coronary artery (LCA) on the background of severe damage to triple vessel coronary artery with Chronic Total Occlusion (CTO) of the right coronary artery (RCA) have indications and decisive choice the most optimal to ensure safety and effectiveness.

Methods: Clinical case report and literature review. Study of one case of myocardial infarction caused by Lm and LCx of the LCA with CTO of the RCA on the background of severe damage to triple vessel coronary artery with an old myocardial infarction having 3 stents placed at the Vietnam National Heart Institute in 2016, indicated for PCI of the left coronary artery (LCA) or coronary artery bypass grafting (BCAG) or CTO intervention of the RCA. The decision to choose the Lm and LCx percutaneous coronary intervention (PCI).

Results: An 83-year-old male patient was admitted to the Vietnam National Heart Institute in August 2023 for myocardial infarction due to Lm and LCx of the LCA. Medical history of 3 vessel coronary artery disease (CAD) with an old myocardial infarction having 3 stents placed including the LAD and LCx intervention as well as CTO intervention of the RCA in 2016 on the background of atrial fibrillation, heart failure, hypertension and dyslipidemia. Solved the patient has indicated for PCI intervention as well as CABG or CTO intervention. The decision made was to perform PCI intervention of the Lm and LCx based on individual analysis and the patient's condition. The results of the PCI intervention in the case were safe and successful.

Conclusions: The decision to choose the PCI intervention or coronary artery CTO intervention or BCAG method for each individual in each patient situation is very important, it is necessary to come up with a reasonable and timely plan with the primary goal of improving the patient's prognosis, symptoms, and quality of life. With today's medical advances and the interventional experience of doctors, coronary artery CTO intervention or BCAG has become more widely indicated, but requires strategy, careful preparation, and advanced techniques in surgery or CTO intervention.

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INTRODUCTION

The damage to triple vessel coronary artery disease (CAD) is the progression of damage to the 3 branches of the coronary arteries and it puts the patient at risk of complications such as heart attack, acute myocardial infarction and stroke. Percutaneous coronary intervention (PCI) is a minimally invasive non-surgical procedure used to treat the narrowing of the coronary arteries of the heart found in coronary aretery disease. The procedure is used to place and deploy coronary stents, a permanent wire-meshed tube, to open narrowed coronary arteries [1-4].

Chronic Total Occlusion (CTO) is defined as 100% occlusion (TIMI 0 flow) of the coronary artery for 3 months or more [1], [2], [3]. In terms of epidemiology, CTO lesions are not uncommon, ranging from 15-35% of percutaneous coronary angiography. Recent studies have also shown that among patients with severe coronary artery disease on percutaneous coronary angiography nearly half of the cases were found to have at least one branch with CTO. Despite its high incidence, CTO intervention is one of the most difficult techniques in percutaneous coronary intervention. Only about 10% of CTO cases undergo coronary revascularization intervention because this procedure usually has a low success rate and most cases of failure are due to the guide wire not being able to pass through the lesion while the complication rate is high, requiring interventional doctors to be highly experienced in intervention [4-13], that is why most patients receive coronary artery bypass grafting (CABG), which is still the gold standard in CTO revascularization [14].

The conventional approach to treating CTO in percutaneous coronary intervention (PCI) involves clear planning, increased use of supporting devices as well as tools to intervene in blocked vessels. You can use the right femoral artery access, choose a guiding (Introducer) with large size 6-8 Fr to optimize the supporting role of guiding. In most cases, flexible guides are used first to check the characteristics of the lesion before moving on to stiffer guides that can penetrate the tip of the occlusion. Using over-the-wire balloons or microcatheters may increase the likelihood of successful passage through the lesion. Once the occlusion has passed, dilation and stent placement are performed in the usual way [1], [16-22].

Coronary Artery Bypass Grafting (CABG) is a bypass surgery on severely narrowed or blocked coronary arteries that are not suitable for stent placement. Traditional CABG requires a mid-sternal thoracotomy. A cardiopulmonary bypass machine is used to establish extracorporeal circulation, allowing cardiac arrest and expulsion of blood from the heart to maximize surgical exposure and facilitate anastomosis. The left internal mammary artery is usually dissected and used to anastomose to the anterior interventricular artery. Other vascular grafts are usually taken from the saphenous vein in the patient's leg. However, CABG also faces some complications, so it is necessary to consider carefully before making a decision; In experienced centers, the mortality rate in this surgery in patients with good physical condition is usually less than 1% to 3% [14], [15], [23].

In reality, when considering the choice of percutaneous coronary intervention (PCI) in CTO or coronary artery bypass grafting (CABG), the primary goal must still be to improve the patient's prognosis and symptoms; Relying on the specific and individualized clinical condition of each patient is very important, however it is always a difficult issue that requires careful consideration when faced with the choice of PCI intervention or CTO intervention or CABG for patients [24], [25]. Therefore, we present a clinical case of myocardial infarction due to the left coronary artery on the background of severe damage to the triple vessel coronary artery with an old myocardial infarction having 3 stents placed with CTO of the RCA and chosen for successful PCI intervention indication.

RESEARCH METHODS

Clinical case report and literature review. A study of one case of myocardial infarction caused by the left main (Lm) and left circumflex (LCx) of the left coronary artery (LCA) on the background of severe damage to triple vessel coronary artery with an old myocardial infarction having 3 stents placed with CTO of the right coronary artery, and indicated for CTO intervention or PCI intervention or CABG at the Vietnam National Heart Institute – Bach Mai Hospital

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in August 2023. The decision made was to perform PCI intervention of the Lm and LCx based on individual analysis and the patient's condition.

RESULTS

An 83-year-old male patient was admitted to the Vietnam National Heart Institute - Bach Mai Hospital in August 2023. The patient was admitted to the hospital with angina and difficulty breathing. The patient has a medical history of Triple Vessel Coronary Artery Disease with LAD and LCX intervention, and right coronary artery CTO intervention since 2016, on the underlying pathology of heart failure, hypertension, atrial fibrillation, and dyslipidemia being treated with prescription Plavix 75 mg, Xarelto 15 mg, Crestor 20 mg, Diovan 80 mg, Concor 5 mg, Vastarel 35 mg x 2 tablets/day. 3 days before admission, the patient had episodes of left chest pain, each episode lasting about 15 minutes with difficulty breathing, sweating, no cough, fever, and normal bowel movements. He went to the emergency room at a lower-level hospital and was diagnosed with non-ST elevation myocardial infarction (NSTEMI) as well as He received emergency treatment with oxygen therapy, heart rate control, blood pressure control, pain relief (nitroglycerin), anticoagulants and immediately transferred to the Vietnam National Heart Institute - Bach Mai Hospital in the following condition: Awake, good contact, chest pain, NYHA II dyspnea, pink skin and mucous membranes, clear alveolar murmurs, no rales. Heart rate was regular, frequency 68 cycles/minute, blood pressure 140/80 mmHg, no abnormal murmurs, abdomen soft, not bloated, not swollen, and urinate. This patient received emergency treatment, secondary care monitoring, and emergency tests.

Emergency test results showed Blood Glucose 7.0 mmol/L, Creatinine 103 µmol/L, GOT/GPT 26/18 U/L, Na/K/Cl 143/3.6/104 mmol/L, Troponin T hs 160.7 ng/L, NT-proBNP 372.2 pg/mL. ECG results recorded a sinus rhythm rate of 68 cycles/minute, left axis, QS-shaped image in V1-V3, lead III, mild positive ST elevation in V1-V3, negative elevation in V5-V6. Doppler echocardiography results showed mild mitral regurgitation and aortic regurgitation, thickening of the left ventricular wall, a slight reduction in movement of 1/3 of the interventricular septum toward the apex and the entire apical region, and left ventricular systolic function within normal limits (EF 60%).

Through examination and laboratory tests, the patient was diagnosed with a myocardial infarction and was indicated to undergo percutaneous coronary angiography for intervention. Results of percutaneous coronary angiography using the DSA digital angiography system showed that the left main coronary artery (LM - Left main) was severely narrowed by 50%, the left anterior descending artery (LAD) with stents 1,2,3 was narrowed in the old stent segment 2 by about 60%. For the circumflex artery (LCx), the patient had 95% severe stenosis at the LCx entrance hole on the base of stents 1 and 2, 50% moderate restenosis in the LCx stent, and 90% severe stenosis in the distal LCx. The special issue in the results here for the right coronary artery (RCA) is that the patient had RCA with chronic total occlusion of segment 2 (CTO lesion), with autologous collateral through the RCA but the image of collateral circulation was poor, the lesion covered the bifurcation site in segment II of the RCA.

The patient was indicated to consider RCA branch CTO intervention or LCA branch PCI intervention of CABG. The problem is that this elderly patient had damage to the triple vessel coronary artery and many underlying diseases, so the prognosis was quite conservative for undergoing surgery or CTO intervention. The most difficult thing at that time was choosing between CABG or CTO intervention. This decision was vital and can bring safety, effectiveness, and the best future outcome for the patient.

The patient had total occlusion of segment 2 of the RCA, with a lesion filling the bifurcation from segment 2 of the RCA into a side branch from segment 2 of the RCA. Normally this is a very functional artery (its function is great, providing a lot of blood to the heart) but it underwent chronic total occlusion (CTO) in segment 2 and had autologous collateral but the collateral circulatory system was quite poor, requiring revascularization of this occluded coronary artery segment or bypass to reperfuse the area of myocardium it innervates, in addition, this occluded coronary artery segment filled a bifurcation into a side branch of the right coronary artery. Many studies using IVUS have shown that atherosclerotic plaques in main blood

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vessels almost spread into side branches. In addition, balloon dilatation can cause plaque displacement (called the 'snowplow' effect) into side branches. Therefore, if choosing CTO intervention of segment 2 of this RCA on a coronary artery base with damage to many coronary artery trunks, doctors have to face the atherosclerotic plaque that has caused narrowing of the coronary artery bifurcation which is also another challenge for interventional cardiologists, intervention in coronary bifurcation lesions has a higher rate of restenosis than others. If choosing the CABG option, many risks may occur in the elderly patient's condition with damage to the triple vessel coronary artery, and many serious accompanying diseases (atrial fibrillation, heart failure, hypertension, atherosclerosis), with a risk of complications such as arrhythmia, stroke during surgery, bleeding, thromboembolism, infection, and intensive resuscitation after surgery, etc. Finally, the patient was given advice and indicated for left coronary arteries PCI intervention because it was the culprit causing acute myocardial infarction in this episode with the consent of his family. The results of PCI intervention using PCI were favorable, no complications occurred during the procedure or after the intervention; the patient gradually stabilized and was discharged from the hospital after nearly one week.

DISCUSSIONS

Coronary artery intervention with the left main coronary artery on the background of damage to three coronary artery diseases have complete blockage of the RCA is very likely to pose many risks during the intervention process, requiring careful consideration before deciding to intervene as well as requiring the experience of the intervention team [1-5].

PCI in CTO is increasingly performed despite the risks of possible complications. The CTO procedure has complications such as the procedure may take a long time, and the patient is at increased risk of being exposed to a significant amount of X-rays and contrast medium; therefore, complications can easily occur. This must be considered when explaining and getting the patient to commit to the procedure. Complications may include: Damage to collateral circulation branches, retrograde coronary artery dissection, coronary artery perforation, guidewire entrapment, subacute coronary artery re-occlusion, and contrast-induced kidney injury. The most important thing is to plan a pre-intervention strategy, including a checklist of limits on contrast dose, radiation, time on the intervention table and technique, guiding, guidewire, guidelines and a detailed step-by-step strategy. The more thoughtful the planning, the greater the likelihood that the procedure will be successful. In general, when preparing for CTO intervention, it is necessary to always be ready to handle complications because CTO intervention has a much higher complication rate than conventional interventions [1].

However, coronary artery bypass grafting (CABG) also faces some complications such as the need to cut the sternum, cardiopulmonary bypass, surgical wound infection that sometimes occurs and can cause mediastinal infection and sternal osteomyelitis, making treatment quite difficult; other complications include bleeding (due to a variety of factors including hemodilution, use of heparin, decreased platelet function due to exposure to the circulatory pump, disseminated intravascular coagulation, and hypothermia), organ dysfunction including neuropsychiatric effects, arrhythmia, myocardial ischemia, global myocardial ischemia, and stroke in about 1.5%; fatal complications depend mainly on the patient's underlying condition as well as the experience of the surgeon and surgical team, post-operative resuscitation, etc. The indication for this method is changing because percutaneous coronary intervention is being widely used. Many statistics have shown that in centers with experience in cardiovascular surgery, the perioperative mortality rate in patients in good health condition is usually less than 1% to 3% [14].

Comment: The patient is old, in the stage of sub-acute myocardial infarction, with severe damage to many coronary artery branches and many underlying cardiovascular diseases (atrial fibrillation, heart failure, hypertension, atherosclerosis). The patient had stents placed in the left coronary artery and anterior interventricular artery and also had the first CTO intervention 4 years ago for chronic total occlusion (CTO) of the right coronary artery (RCA). Currently, the completely re-occluded lesion of segment II of the RCA does not have much collateral circulation,

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indicating that the gradually to completely occluded RCA lesion has also reappeared recently. The damage to segment II of the RCA filled a side branch in segment II, while segment I was only slightly narrowed. The first part of the occlusion had a tapered lesion that did not have a blunt occlusion, which made the prognosis for CTO intervention more positive. Therefore, we gave advice and the patient's family agreed to choose the right coronary artery (RCA) CTO intervention with drug-eluting stent (DES) placement after revascularization rather than performing coronary artery bypass grafting (BCAG) [26]; Therefore, the patient underwent PCI intervention in Lm and LCx of the left coronary artery (LCA), the patient received balloon dilation and 2 drug-eluting stents were placed at the Lm and LCx branch. The intervention results were quick and favorable, with no complications during or after the intervention.

Stents help improve the results before CTO intervention when compared with balloon dilatation alone. However, the long-term results of patient with CTO intervention are often not positive because the rate of in-stent restenosis is relatively high. This has been partially improved with the use of new generations of drug-eluting stents (DES), with long-term effectiveness demonstrated in several randomized controlled trials (RCTs). Based on recent data, using new generation drug-eluting stents (everolimus, zotarolimus) in the treatment of bifurcation lesions is more effective in reducing restenosis and re-intervention rates [26], [27]. Therefore, patients with PCI intervention on the background of chronic total occlusion disease (CTO) and at high risk of restenosis should consider using DES during PCI intervention (ESC 2018) [28], [29].

For coronary intervention in multi-vessel coronary lesions, previous studies in the bare metal stent (BMS) era showed that percutaneous coronary intervention (PCI) using BMS was less effective than coronary artery bypass grafting (CABG) in multi-vessel coronary lesions to reduce angina symptoms and re-intervention. In general, these studies included patients with low risk, less complicated coronary artery lesions, and good left ventricular function. Stents will help improve the problem of reduced vascular elasticity and negative remodeling. Evidence has shown that intimal proliferation subsequently causes in-stent restenosis, which is the main limiting factor in coronary stenting procedures. Drug-eluting stents are stents covered with an outer layer capable of releasing biologically active components into local tissues and blood vessels. The appearance of drug-eluting stents to help reduce the rate of in-stent restenosis has fundamentally changed the treatment of patients with coronary artery disease [14], [26].

The SYNTAX study (comparison between coronary intervention with the TAXUS stent and coronary artery bypass grafting) is the largest prospective, randomized, multicenter trial including all patients with complex multi-vessel coronary lesions (left main coronary artery and complex multi-vessel coronary lesions). A total of 1,800 patients from Europe and the United States were randomized to multi-vessel coronary artery PCI using TAXUS drug-eluting stents or CABG, based on a heart team's revascularization strategy decision, including interventional cardiologists and surgeons. Exclusion criteria were previous revascularization, myocardial infarction, or the need for concurrent cardiac surgery. The results showed that: Within 1 year, the rate of patients requiring recanalization in the PCI group was significantly higher (13.5% versus 5.9%); however, the rates of bridge occlusion or stent occlusion were similar. There was a significant increase in the number of stroke patients in the CABG group (2.2% versus 0.6%). Major Cardiovascular Event (MACE) Rates recommended PCI for simple multivessel coronary lesions with less complex anatomy and CABG for complex left main coronary artery lesions. The study also showed that safety outcomes (death/CVA/MI) in the triple vessel coronary artery group were similar for PCI and CABG but the 2-year reintervention rates and MACE favored CABG. Particularly for the group involving the left main coronary artery (LM), there was no difference in all-cause mortality between the PCI and CABG (4.2% versus 4.4%) and MI (4.3% versus 4.1%) [27].

However, in this patient, who is elderly, has 3-vessel coronary artery disease with complete right branch occlusion, and complex underlying disease, CABG surgery or CTO intervention is an issue that needs to be carefully considered, while the RCA branch has

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collateral circulation, this acute myocardial infarction injury is caused by the left main coronary artery, so the priority is to be treated with coronary artery revascularization intervention. The recent appointment and selection is the right decision, proven by the fact that the patient no longer has chest pain, no longer has difficulty breathing, and feels more comfortable and safe after the intervention. CTO intervention or CABG surgery will be the next step after the patient has recovered stably for a certain period.

Many studies have shown that there are factors that predict the possibility of failure of the procedure, often in situations with long segment injury, long occlusion time, calcified lesion, multiple collateral circulations, the first part of the occlusion being blunt (as opposed to tapered), the presence of a side branch at the occlusion point, twisted coronary artery, etc. These studies further demonstrate that choosing percutaneous left coronary artery (Lm and LCx) intervention situation is a timely and correct choice, helping the patient overcome a dangerous situation and ensuring safety and a good prognosis in the future [15-27].

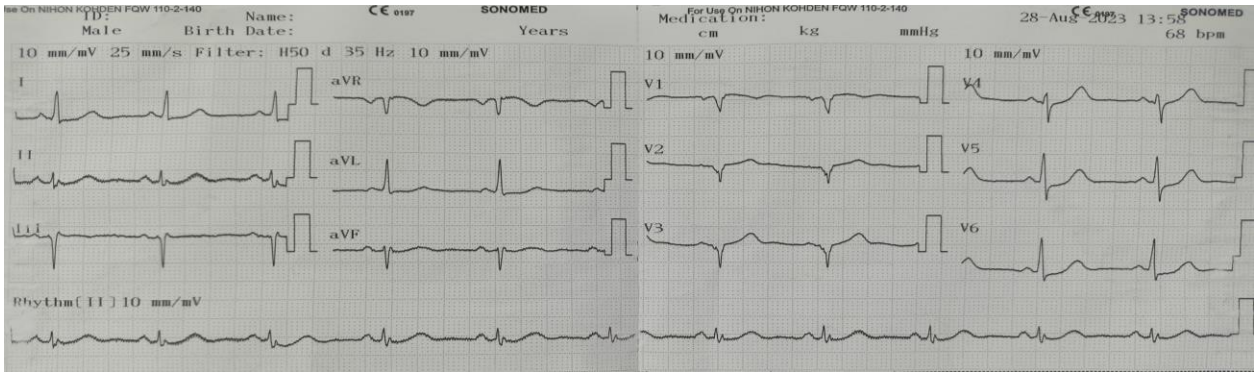

Figure 1: Electrocardiogram before PCI intervention

Figure 2: Result of coronary artery angiography before PCI intervention

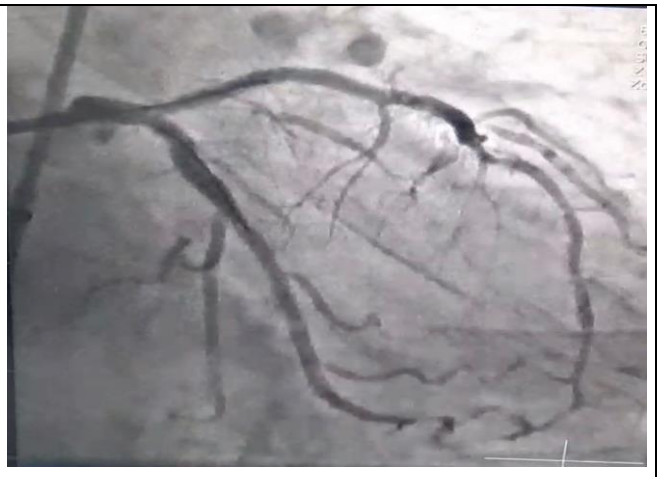

Figure 3: Result of coronary artery angiography after PCI intervention

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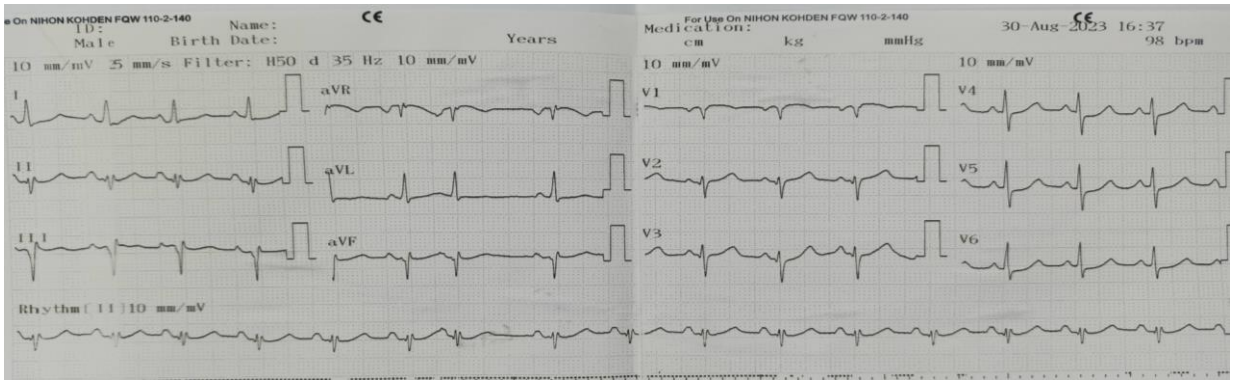

Figure 4: Electrocardiogram after PCI intervention

CONCLUSIONS

The decision to choose the coronary artery PCI intervention as well as CTO intervention or BCAG method for each individual in each patient situation is very important, it is necessary to come up with a reasonable and timely plan with the primary goal of improving the patient's prognosis, symptoms, and quality of life. With today's medical advances and the interventional experience of doctors, coronary artery PCI intervention in patients with damage to triple vessel CAD and CTO branch has become more widely indicated; however, it is necessary to be very careful when choosing PCI intervention because it must be based heavily on the specific clinical situation and individualization of each patient, in addition, it also requires strategy, careful preparation, and advanced techniques in PCI intervention.

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