

Case Report

Rheolytic Thrombectomy Combined with a Protective Filter and Platelet Glycoprotein IIb/IIIa Receptor Inhibitors in Rescue Angioplasty

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Rescue angioplasty is used in patients in whom thrombolysis has been unsuccessful, in order to achieve a better restoration of flow and to improve left ventricular function and the long term prognosis. However, patients who undergo rescue angioplasty have a higher rate of reocclusion of the vessel or distal embolism, resulting in increased mortality. Rheolytic thrombectomy, which reduces the quantity of thrombus and improves flow in the vessel, has been used successfully in such cases. We describe a case in which rheolytic thrombectomy was applied during late rescue angioplasty in order to achieve immediate restoration of flow in the vessel.

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During the last 20 years thrombolytic therapy has become established as one of the treatments of choice for patients with acute myocardial infarction. More recently, primary angioplasty has proved effective and a recent analysis of 23 randomised studies showed lower rates of reinfarction, stroke and death for primary angioplasty compared with thrombolysis.¹ However, because of the limited availability of primary angioplasty for acute myocardial infarction, thrombolysis remains the initial treatment of choice. Unfortunately, around 40% of arteries do not respond to thrombolytic treatment. In these cases the culprit artery shows either complete (TIMI 0 flow) or subtotal obstruction (TIMI I/II flow) and the patients have a worse prognosis with regard to left ventricular function and overall mortality.² Rescue angioplasty is used in patients in whom thrombolysis has been unsuccessful and results in a better restoration of flow, with an improvement in left ventricular function and in the long term prognosis.³ However, patients who undergo rescue angioplasty have a high rate of reocclusion

of the vessel or distal embolism, resulting in increased mortality.⁴ Rheolytic thrombectomy, which reduces the quantity of thrombus and improves flow in the vessel, has been used successfully in such cases.⁵ We describe a case in which late rescue angioplasty was augmented by rheolytic thrombectomy to achieve immediate restoration of flow in the vessel.

Case description

A man aged 47 years, with no previous history of cardiac disease, was transferred to our department 36 hours after suffering an acute myocardial infarction. He had initially been treated with thrombolysis and came to us for further investigation because of heart failure. Clinically, the patient was in Killip class 3, with a low cardiac output and systolic blood pressure 80 mmHg. His echocardiographic ejection fraction was 25%. Coronary angiography showed complete occlusion of the proximal left anterior descending branch (distal flow TIMI 0) with extensive thrombus (Figure 1), a dominant circumflex artery

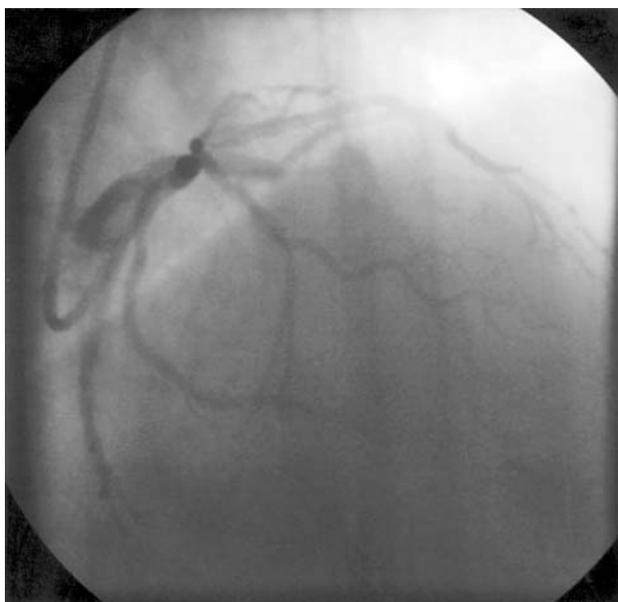


Figure 1. Complete occlusion of the proximal anterior descending coronary artery branch (distal flow TIMI 0) with extensive thrombus.

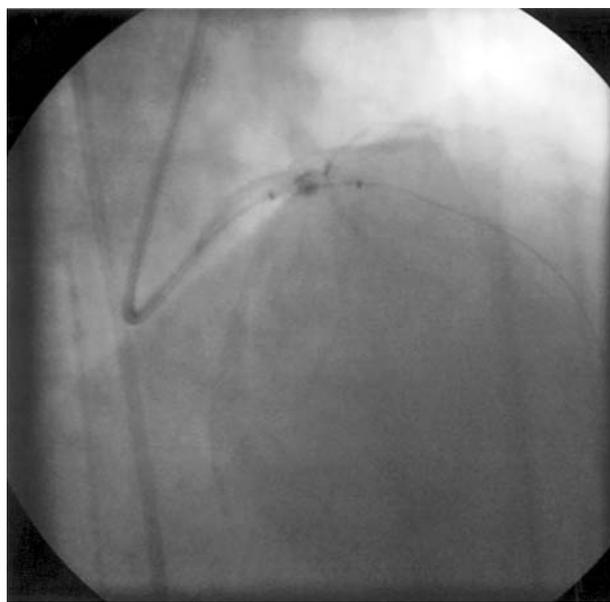


Figure 2. A pass through the thrombotic obstruction with a rheolytic thrombectomy catheter (4F Angiojet, Monorail XMI, Possis Medical, Inc.).

with no stenosis and significant stenosis in a non-dominant right coronary artery.

An intra-aortic balloon pump was used throughout the angiography and angioplasty. Intravenous administration of a platelet glycoprotein IIb/IIIa receptor inhibitor (abciximab) was started before the angioplasty. An XB 3.5 7F guiding catheter (Cordis) and a Choice PT guidewire (Boston Scientific) were introduced to the blocked section of the left anterior descending artery. A rheolytic thrombectomy catheter (4F Angiojet, Monorail XMI, Possis Medical Inc., Minneapolis, Minnesota) was then passed twice through the thrombotic obstruction (Figure 2). The total duration of the passes was 30 seconds. During the thrombectomy the patient exhibited acute ST segment elevation in all anterior leads together with a drop in blood pressure (systolic 60 mmHg). In consequence, the duration and the number of thrombectomy passes were curtailed. The ST segment elevation disappeared once the passes with the rheolytic thrombectomy catheter were completed. Immediately after the second pass of the thrombectomy catheter a significant longitudinal atherosclerotic stenosis was revealed, with a moderate degree of thrombus and distal TIMI flow I (Figure 3). Because of the incomplete thrombectomy a distal protective EPI filter (Boston Scientific) was inserted. A Taxus 3528 stent (Boston Scientific) was then deployed at 14 Atm (Figure 4). The protective filter was removed with a moderate amount of thrombus within it.

The final angiography showed full restoration of flow (TIMI III) without residual stenosis and no signs of distal embolism (Figure 5). After transfer to the intensive care unit the patient continued to receive intravenous abciximab for 24 hours and heparin for 48 hours. The intra-aortic balloon pump was removed 48 hours after the angioplasty. Five days later the patient's echocardiographic ejection fraction was 50%. He was discharged on the sixth day with no complications.

Discussion

Randomised studies have validated rescue angioplasty after unsuccessful thrombolysis as regards the safety of the method, its efficacy in reducing immediate and long-term major cardiac events and in improving left ventricular function.^{6,7} The RESCUE study⁶ showed a clear improvement in cardiac function and a reduction in mortality during the first 30 days after an extensive anterior infarction and rescue angioplasty, a finding that remained true at one-year follow up. However, restoration of TIMI III flow in the vessel is not enough: it is also imperative to restore myocardial perfusion as far as possible at the level of the microcirculation.⁸ The presence of large quantities of thrombus in the vessel when a patient has already shown resistance to thrombolytic treatment, in combination with the likelihood of hypotension, contributes to the occurrence of distal em-

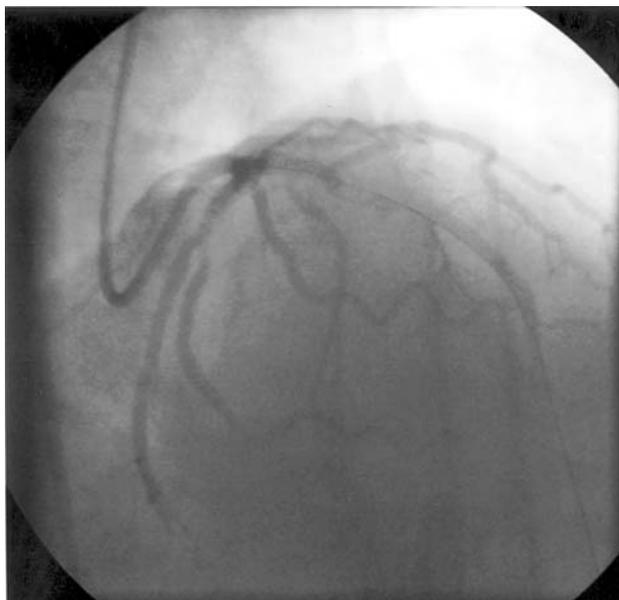


Figure 3. Immediately after the second pass of the thrombectomy catheter a significant longitudinal atherosclerotic stenosis was revealed, with presence of a moderate degree of thrombus and distal flow TIMI I.

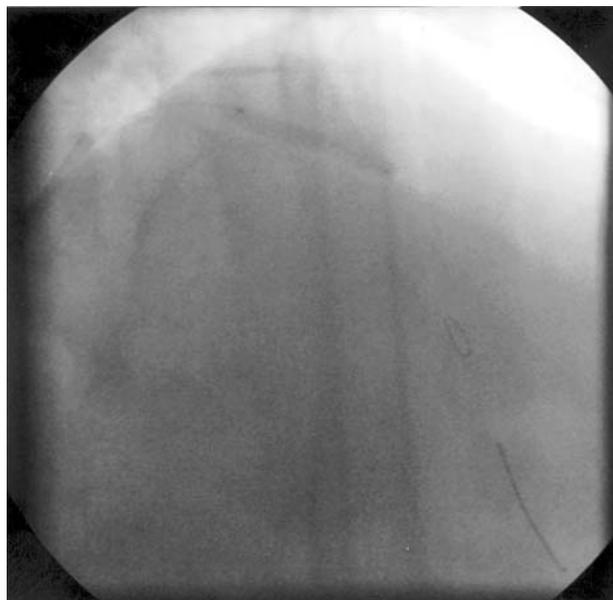


Figure 4. Direct deployment of a Taxus 3528 stent (Boston Scientific) at 14 Atm.

bolism, resulting in severe disturbances of tissue perfusion despite the restoration of epicardial flow. The combination of distal embolism with tissue oedema often leads to destruction of the microcirculatory net and the simultaneous release of vasoactive cytokines, which have an unfavourable effect on left ventricular function. Thus, rescue angioplasty in many centres is combined with various techniques aimed at a fuller restoration, not only of epicardial flow, but also of the microcirculation. The application of new technologies and adjunctive therapies – such as direct (without predilatation) implantation of stents, which stabilise the lumen, reduce the likelihood of distal embolism and reduce restenosis,^{9,10} platelet glycoprotein IIa/IIIb receptor inhibitors, which reduce early and total mortality,^{11,12} and a protective filter to reduce distal embolism¹³ – has contributed to achieving the best possible outcome in rescue angioplasty. The intra-aortic balloon pump has also proved beneficial in many cases of rescue angioplasty.¹⁴ Often, however, the quantity of thrombus is large and the above techniques are insufficient to disperse it fully. Rheolytic thrombectomy, which reduces the quantity of thrombus and improves flow in the vessel, has been used successfully in such cases.⁵ The AngioJet catheter is a new system for breaking up and aspirating thrombus, based on the principle of rheolytic

thrombectomy, which has been used in high risk cases.^{15,16} The device has been used in venous grafts with very good results.¹⁷ It includes a 5F diameter catheter that can be used with an angioplasty guidewire, and is



Figure 5. The final angiogram showed full restoration of flow (TIMI III) with no residual stenosis or distal embolism.

based on Bernoulli's principle (a high- and low-pressure system for breaking up and aspirating thrombus). There are recent studies reporting its use in acute myocardial infarction.^{18,19} The basic conclusion from the above studies is that rheolytic thrombectomy before intracoronary stenting is practical and results in more effective reperfusion, with restoration of TIMI III flow and a reduction in the size of the infarct. The incidence of complications (arrhythmias, vessel perforation, distal embolism) is small.²⁰ Rheolytic thrombectomy causes platelet haemolysis and local hyperkalaemia. A sudden and dramatic ST segment elevation may be observed, and is usually the result of the above complication, which causes repolarisation disturbances.²⁰ The treatment is usually symptomatic and imposes a limitation on thrombectomy time. In the present case the ST interval elevation was accompanied by a deterioration in the already severe haemodynamic status and in view of this the thrombectomy time was curtailed. As a result, the thrombus was not completely aspirated and it was judged necessary to insert a protective filter before the direct stent deployment. The patient's poor haemodynamic condition necessitated the placement of an intra-aortic balloon pump from the start and this was left in position for 48 hours.

The effectiveness of rheolytic thrombectomy in this case, and its relative ease of use, have led us to apply it frequently in similar cases in our laboratory, especially in those with total thrombotic occlusion of the vessel and widespread thrombus, where the insertion of a protective filter is technically very difficult. Apart from the case described here, we have since used the rheolytic thrombectomy technique in combination with rescue angioplasty in another 11 patients with complete success.

Conclusions

Rheolytic thrombectomy is an effective adjunct to rescue angioplasty in cases with extensive thrombus. The aspiration of non-organised thrombus from an active lesion, in combination with direct stent deployment, the use of glycoprotein IIa/IIIb receptor inhibitors, and a protective filter when deemed necessary, is a safe, rapid and effective method that significantly reduces the likelihood of distal embolism. This improves the efficacy of rescue angioplasty after unsuccessful thrombolysis, with restoration of TIMI III flow in the vessel and the best possible preservation of myocardial function, immediately and in the long term. Larger studies will be needed to establish the use of this technique in

cases of angioplasty in the presence of extensive thrombus.

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