tic plaque rupture, and in the remaining 30%, there is plaque erosion (4). Disruption of the atherosclerotic plaque results in the sub-endothelial thrombogenic matrix being exposed to circulating platelets, leading to platelet adhesion, aggregation, and white thrombus formation. The concomitant release of tissue factor from the site of arterial injury activates the extrinsic coagulation cascade, resulting in the formation of thrombin, which then converts fibrinogen to fibrin. This process culminates in the formation of a red thrombus composed of more densely packed platelets, erythrocytes, inflammatory cells, and fibrin, which over time becomes progressively more robust (5).

Massive intracoronary thrombi are associated with reperfusion failure and more unfavorable clinical outcomes (6–9). If not treated thoroughly, intracoronary thrombus can cause distal and microvascular obstruction, which is known as the no-reflow phenomenon. The no-reflow phenomenon can occur in 50% of cases of acute coronary syndrome (ACS) with a high thrombus load, resulting in reduced myocardial perfusion at the microvascular level, increased infarct size, and higher mortality (10, 11).

Intracoronary thrombus is defined as a filling defect with decreased contrast density. Quantification of intracoronary thrombus can be performed by angiography using the TIMI thrombus grade. The TIMI thrombus scale relies on relative estimates of the size of the thrombus and affected vessels, using a scaled score of 0 (no thrombus) to 5 (total occlusion by thrombus) (12). The TIMI thrombus scale can be simplified into a low thrombus load (grades 1–3) and a high thrombus load (grades 4–5) (13).

Current guidelines recommend primary PCI as the treatment of choice for STEMI patients. Primary PCI with stent implantation can restore patency in the IRA, resulting in a smaller infarct area and a lower number of acute and long-term events, including recurrent infarction and death (2). However, until now, there has been no gold-standard therapy for lesions with a high thrombus burden. Several mechanical and pharmacological approaches have been proposed to reduce the thrombus burden and post-PCI complications.

Platelet Inhibition

Early administration of dual antiplatelet therapy (DAPT) can reduce the thrombus burden and improve clinical outcomes. Aspirin can be given orally by chewing or intravenously at an initial dose of 150–300 mg to inhibit thromboxane A2-mediated platelet activation (Class I; LOE B). The onset of action of aspirin occurs within 30–60 minutes and persists for the lifetime of the platelets. Potent P2Y12 inhibitors such as prasugrel 60 mg or ticagrelor 180 mg can be selected if available, or clopidogrel 600 mg if more aggressive treatment is contraindicated (Class I; LOE A). Prasugrel and ticagrelor have a more rapid onset of action, stronger potency, and are superior to clopidogrel in clinical outcomes. Intravenous P2Y12 agents (cangrelor) may also be considered in patients who have never taken an oral P2Y12 receptor inhibitor at the time of PCI or in those who are intubated and unable to take oral agents (Class IIb; LOE A) (2).

Glycoprotein IIb/IIIa (GPI) inhibitors are angiographically proven effective agents for dissolving a thrombus and are capable of restoring TIMI flow by inhibiting the final pathway of platelet aggregation through competition for binding of GP IIb/IIIa receptors with von Willebrand factor and fibrinogen. GPIs inhibit platelet response to all agonists, resulting in rapid and almost complete inhibition of platelet aggregation, making them more potent antiplatelet agents than P2Y12 inhibitors (14). Despite the proven efficacy of GPI in primary PCI settings, high bleeding rates remain a concern. In a meta-analysis of 10,123 patients undergoing primary PCI, Winchester et al. (15) reported that using GPI reduced non-fatal myocardial infarction (MI) at 30 days (5.1% vs. 8.3%; $p < 0.001$) with a significant increase in cost and risk of minor bleeding (3% vs. 1.7%; $p < 0.001$). Based on available data, current guidelines state that the routine use of upstream GPIs in STEMI cases is not recommended, but should be considered for bailout if there is evidence of the no-reflow phenomenon or thrombotic complications (Class IIa; LOE C) (2). Our patient did not receive GPI therapy due to its unavailability at the time of PCI. Nevertheless, we used several strategies, namely MAT, balloon angioplasty, and intracoronary thrombolysis, during PCI to obtain good results.

Anticoagulation

Effective anticoagulation must be maintained during primary PCI to inhibit the coagulation cascade and thrombus formation. Unfractionated heparin (UFH) is the most widely used anticoagulant of choice for primary PCI, besides enoxaparin and bivalirudin. Heparin binds to antithrombin, which causes surface changes and deactivates thrombin. Antithrombin binding blocks two major factors of the coagulation cascade: thrombin (Factor IIa) and Factor Xa, blocking the conversion of fibrinogen to fibrin, thereby preventing clot formation (15). Although there are no randomized, placebo-controlled studies evaluating UFH in primary PCI, there is considerable experience with this agent. Therefore, the routine use of UFH in primary PCI remains a class I (LOE A) recommendation (2).

In the ATOLL study involving 910 STEMI patients, enoxaparin 0.5 mg/kg IV bolus compared to UFH did not significantly reduce the primary composite endpoint of 30-day death, recurrent MI, procedural failure, or major bleeding, but there was a decrease in the secondary endpoint of death, recurrent MI, or urgent revascularization (16). In contrast, a meta-analysis of 23 PCI studies (30,966 patients, 33% primary PCI) reported the superiority of enoxaparin over UFH in reducing mortality and bleeding outcomes in the context of primary PCI (17). Based on these data, the routine use of IV enoxaparin should be considered during primary PCI (Class IIa; LOE A) (2).

The use of bivalirudin in PCI has shown no advantage over UFH, but data have shown a reduced risk of major bleeding in a recent meta-analysis of five trials (10,350 patients), although this was offset by an increased risk of acute stent thrombosis (18). Based on these data, the use of bivalirudin as an anticoagulant during primary PCI procedures is recommended for class IIa (LOE A) in patients with a high risk of bleeding or class I recommendations (LOE C) for patients with heparin-induced thrombocytopenia (2).

PCI Strategy

ACS differs from stable coronary artery disease in which the thrombus burden is higher. Compression or displacement of a thrombus by a balloon or strut stent can result in distal embolization and microvascular dysfunction.