Contents list available at www.heartscience.ub.ac.id

Heart Science Journal

Journal Homepage : www.heartscience.ub.ac.id

Case Report

Tailoring risks and benefits of invasive strategy in patient with non ST elevation myocardial infarction coexist anemia gravis due to active gastrointestinal bleeding

Mokhammad Afifuddin[1*], Mohammad Saifur Rohman[2,3]

[1] Brawijaya Cardiovascular Research Center, Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia
[2] Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia
[3] Dr. Saiful Anwar General Hospital, Malang, East Java, Indonesia

ARTICLE INFO

Keyword :
Anemia gravis;
Gastrointestinal bleeding;
Myocardial Infarction.

ABSTRACT

Background: Myocardial infarction needs revascularization and antiplatelet agents. Nonetheless, the use of antiplatelet agents exacerbates hemorrhagic manifestations in individuals with pre-existing gastrointestinal bleeding. This case involves a patient who suffered from both a myocardial infarction and gastrointestinal hemorrhage.
Case Presentations: An 84-year-old man had escalating chest pain for 10 days before to admission, with a history of heart failure for the last 3 years. He also had melena caused by over-the-counter analgesics. The ECG in the emergency department indicated ST elevation in aVR and ST depression in leads I, II, III, aVL, and V4-V6, accompanied with hs-Troponin I levels of 1945 ng/L and hemoglobin at 5 g/dL. He was assessed as high-risk Non ST Eleveation Myocardial Infarction (NSTEMI), with a Grace score of 210, while experiencing severe anemia owing to ongoing gastrointestinal bleeding. The patient received a PRC transfusion, a proton pump inhibitor, and sucralfate syrup. Angiography revealed critical stenosis with thrombus in diagonal one of the left anterior descending artery and significant calcified stenosis in the distal left circumflex artery. Consequently, one drug-eluting stent was inserted in the osteal-distal left anterior descending artery. The clinical symptom subsequently improved. Aspirin and Clopidogrel were provided post-stent implantation with sequential blood assessments. An endoscopy was also conducted to assess bleeding source.
Conclusions: A patient with NSTEMI and severe anemia owing to active gastrointestinal bleeding had an invasive approach, during which a drug-eluting stent was placed. Administration of dual antiplatelet therapy must be carefully managed.

1. Introduction

Myocardial Infarction (MI) is a cardiovascular event caused by the abrupt cessation of blood supply to the cardiac muscle. In myocardial infarction, a region of the myocardium sustains irreversible damage owing to plaque rupture and subsequent thrombus development, resulting in total blockage of a coronary artery.[1-3]

Revascularization strategies are essential for increasing outcomes, and their procedures are critical for boosting results, necessitating the concurrent use of antiplatelet medication. Nonetheless, antiplatelet agents may provide challenges for individuals experiencing gastrointestinal (GI) bleeding owing to their propensity to exacerbate bleeding symptoms.[4,5] This case involves a patient who had a myocardial infarction and gastrointestinal hemorrhage.

2. Case Illustration

The 84-year-old patient reported suffering shortness of breath for 10 days prior to hospitalization and had been passing black, tarry stools for seven days before admission. Due to his chest pain, his family decided to take him to the emergency services. The patient has been experiencing heart failure for the last three years and has been regularly seeing a cardiologist. Notably, he had been using over-the-counter analgesics for more than a decade, averaging at least three times each week.

The patient's ECG at the prior hospital indicated sinus tachycardia with a heart rate of 104 beats per minute, a regular rhythm, left axis deviation, ST elevation of 2 millimeters in aVR, and ST depression in leads II, III, I, aVL, and V4-V6. Additionally, the patient had minimal instances of premature atrial contraction (PAC). The patient was found to have a hs-Troponin level of 1945 ng/L, resulting in a diagnosis of Non-ST Elevation Myocardial Infarction (NSTEMI). Furthermore, dual antiplatelet therapy was included into the therapeutic regimen, and an invasive procedure was scheduled to occur. The blood test findings indicated that the patient had severe anemia. The patient's hemoglobin level was 5 g/dL, the mean corpuscular volume was 75, and the mean corpuscular hemoglobin was 15. After receiving a transfusion of two units of packed red blood cells, he was refered to tertier hospital for further medical attention due to the worsening severity of his clinical symptoms.

While the patient received vasopressor medicine at the emergency room, their hemodynamics remained stable, and their shortness of breath improved. During the melena incident, the occurrence persisted. Following fluid resuscitation, his blood pressure returned to normal, leading to the discontinuation of the vasopressor medication. His blood pressure was low before his arrival..

* Corresponding author at: Brawijaya Cardiovascular Research Center, Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia
E-mail address: em.afif@gmail.com (M.Afifuddin).

https://doi.org/10.21776/ub.hsj.2026.007.02.15
Received 10 January 2025; Received in revised form 18 February 2025; Accepted 20 February 2025.
Available online 26 April 2026

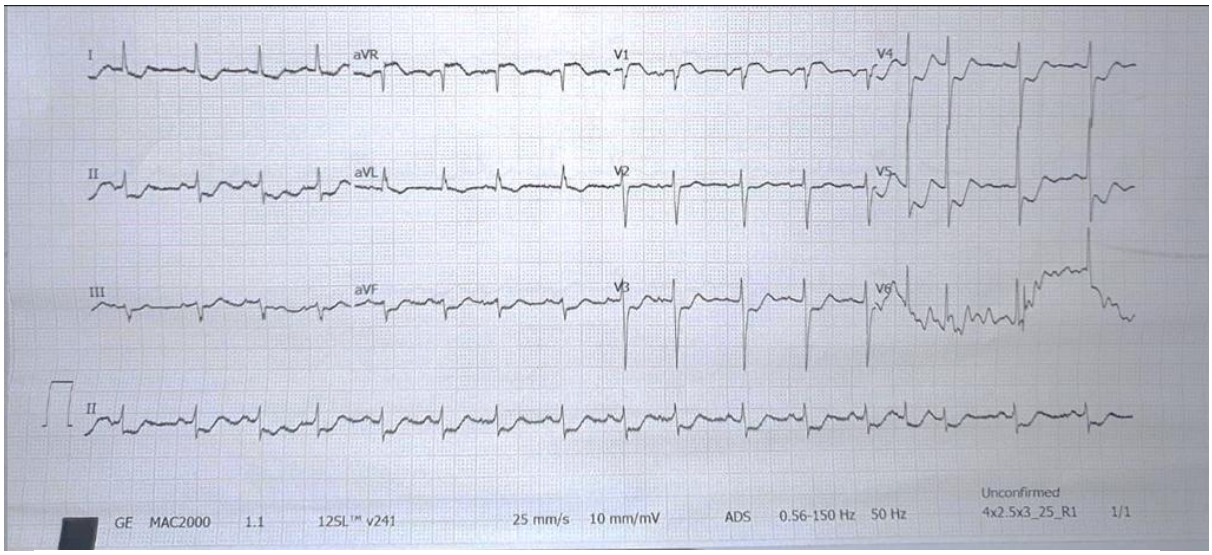

Figure 1. ECG at previous hospital with ST elevation at aVR, ST depression I, II, III, aVL, V4- V6

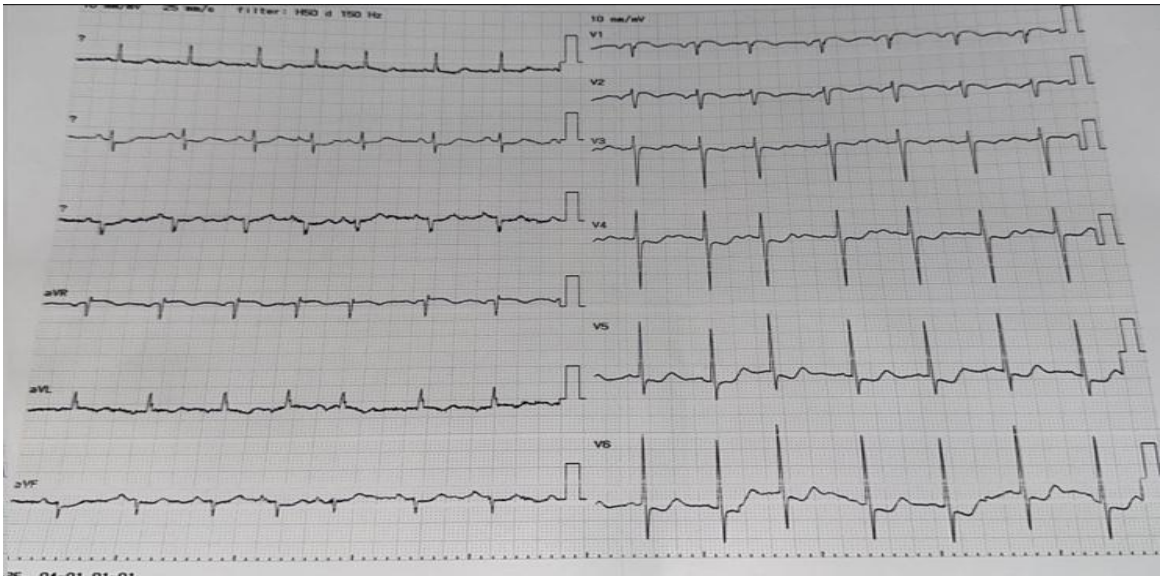

Figure 2. ECG at tertiary hospital showed ST depression in leads II, III, aVF (1 mm), and V3-V6 (2 mm)

The patient had symptoms, including pallor, anemic conjunctiva, elevated extremities, and urine output exceeding 1cc/kgBw/hour. The ECG readings indicated a normal sinus rhythm with a heart rate of 93 beats per minute, left axis deviation, ST segment depression in leads II, III, and aVF, and in leads V3-V6, together with intermittent PAC. The chest X-ray revealed that the patient had cardiomegaly with an embedded apex. Following the acquisition of two units of packed red blood cells from the prior hospital, the hs troponin I and hemoglobin levels increased to 8610 ng/L and 6.9 g/dL, respectively. The mean corpuscular volume (MCV) was 77.9, the mean corpuscular hemoglobin (MCH) was 22.1, the white blood cell count was 6,780/µL, and the platelet count was 238,000/µL.

The patient was subsequently treated in the critical care unit to optimize hemoglobin levels in preparation for an invasive procedure. The complete blood count on the second day of therapy was 7.7g/dL after the administration of 2 units of Pack Red Cell (PRC) transfusion. To administer the required dosages of lansoprazole intravenous administration was executed. On the third day, hemoglobin rose to 9.3g/dL after the administration of one flask of PRC. On the fourth day of therapy, hemoglobin decreased to 8.6g/dL, prompting the administration of 2 units of packed red cells transfusion, with no clinical evidence of melena or hematemesis. The post-transfusion DL assessment was 10.1g/dL with persisted symptoms, after which the patient was prepped for an invasive approach including heparinization.

Following the elevation of the patient's hemoglobin level to the target threshold of over 10 g/dL, diagnostic coronary angiography was conducted. Stenosis was identified in the left anterior descending artery (LAD), characterized by critical stenosis 95% at proximal just before diagonal branch one (D1), calcified critical stenosis 99% at the distal left circumflex artery (LCx) preceding the obtuse marginal 3 (OM3) branch, and diffuse calcified stenosis extending from proximal to distal right coronary artery (RCA), with maximum stenosis 90% located at the proximal RCA prior to the right ventricular (RV) branch. The findings were obtained from the patient's medical evaluation. As a result, a drug-eluting stent was implanted in the osteal-distal segment of the left anterior descending artery, and a percutaneous balloon angioplasty was conducted in the distal left circumflex artery. Cineangiography confirmed the presence of TIMI flow 3 in the LAD, despite the lesion exhibiting recoil after balloon angioplasty in the LCx. The patient received aspirin and clopidogrel at intervals of twenty-four and forty-eight hours, respectively. Nonetheless, the patient persisted in experiencing ongoing melena, even though he indicated a reduction in chest pressure.

One day post-treatment, the patient had black, tarry stools, and their hemoglobin level decreased to 7.3 g/dL. Furthermore, the patient's feces continued to be black. The delivery of aspirin was posponed, whereas clopidogrel was maintained at a frequency of every 48 hours. Furthermore, he had a transfusion of PRC to elevate his hemoglobin level above 10 g/dL.

The endoscopic assessment was conducted indicating that the esophagus mucosa was normal and exhibited no abnormalities. Significant findings were identified in the gastric fundus, where multiple polyps exhibiting hemorrhagic lesions and erosions were observed. The gastric corpus displayed active hemorrhage with observable blood clots, a distinctive snakeskin morphology, and the presence of erosions. The antropyloric region exhibited numerous erosions with associated hemorrhagic signs. Active bleeding was observed in the duodenal bulb and distal pars, signifying significant gastrointestinal hemorrhage necessitating urgent medical attention. The findings indicate significant upper gastrointestinal pathology, likely exacerbating the patient's clinical symptoms and anemia. In light of these results, he was given lansoprazole continuously at a rate of 6mg per hour, in conjunction with sucralfate syrup and a PRC transfusion to target Hemoglobin level over 10g/dL.

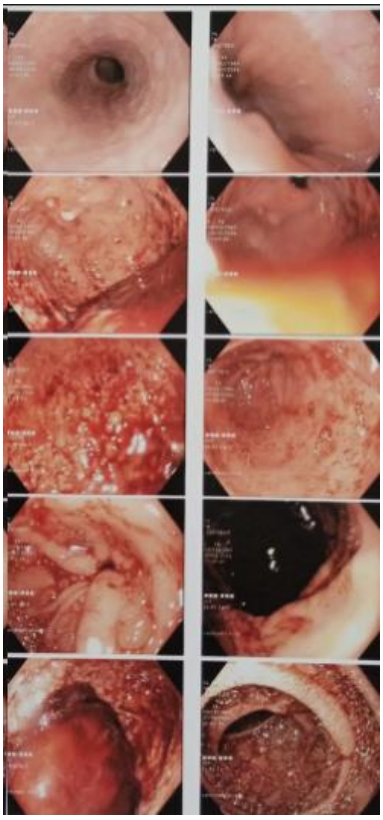

Figure 3. Endoscopy showed multiple polips with erosions. Active bleeding spots with snakeskin appearance at corpus

Abdominal ultrasonography indicated a liver with a normal craniocaudal dimension of around 11.3cm. The liver surface exhibited irregularity, characterized by a rather coarse echoparenchymal texture and gently blunted margins. The portal, vascular, and biliary systems exhibited no dilation. No nodules or cysts were detected. Other abdominal organs were within normal parameters. The ultrasonographic findings indicate parenchymatous liver disease consistent with moderate liver fibrosis (Nishiura score 4) and the presence of cholelithiasis, without dilation of the intrahepatic or extrahepatic bile ducts.

3. Discussion

A geriatric male patient with high-risk NSTEMI had an invasive strategy in accordance with guideline recommendations.[6] The patient received heparin and dual antiplatelet therapy before percutaneous coronary intervention (PCI), which included the placement of a drug-eluting stent in the osteal-distal left anterior descending artery and balloon angioplasty in the distal left circumflex artery. The administration of dual antiplatelet presented a considerable difficulty owing to the patient's advanced age and high Precise DAPT score of 86, requiring a meticulous evaluation of ischemia protection against bleeding risk. Patients over 75 years old need particular attention in the selection and duration of dual antiplatelet, necessitating a complicated therapeutic choice to maximize the equilibrium between thrombotic and hemorrhagic risks.

Subsequent to the intervention strategy, blood tests revealed a hemoglobin concentration of 7.3 g/dL, and the patient had enduring clinical manifestations of melena, indicating continued gastrointestinal (GI) hemorrhage. In light of the increased risk of gastrointestinal hemorrhage linked to aspirin consumption,[7] the decision was made to cease aspirin use and adjust antiplatelet therapy by administering clopidogrel twice daily, in alignment with antithrombotic therapy guidelines.[8] An endoscopic assessment was arranged after PCI due to the occurrence of GI hemorrhage. Some studies indicate no substantial difference between early and late endoscopy in gastrointestinal bleeding cases,[9] while other analyses suggest that endoscopy as a primary intervention may lead to a higher mortality rate (5.5%) compared to patients who receive PCI first (3.9%), although this difference lacks statistical significance.[10] The American Society for Gastrointestinal Endoscopy has not provided explicit guidelines about the scheduling of endoscopy in patients using antithrombotic treatment for acute coronary syndrome, hence complicating the decision-making process.[11]

The patient's extended usage of over-the-counter analgesics contributed to his vulnerability to gastrointestinal bleeding.[12] Furthermore, ultrasound results revealed the existence of mild hepatic fibrosis, a kind of parenchymal liver disease caused by hepatocyte necrosis and subsequent regeneration, eventually culminating in liver cirrhosis.[13] Liver fibrosis and its advancement to cirrhosis are recognized to heighten bleeding risks, hence complicating the treatment of gastrointestinal hemorrhage in this patient.[14]

Post-PCI management of bleeding problems is essential because to its influence on morbidity and mortality. The use of dual antiplatelet, while crucial for mitigating thrombotic occurrences, has markedly heightened the risk of hemorrhage, especially in patients with coronary stents. The PRECISE-DAPT score was created to assess bleeding risks in patients on dual antiplatelet, emphasizing the need of personalized risk stratification in informing treatment choices.[15] Significant hemorrhagic incidents are associated with increased mortality and worse clinical outcomes, including diminished quality of life.[16,17]

The selection of antiplatelet treatment in these instances is essential. Prasugrel and ticagrelor are favored in acute coronary syndrome for their enhanced effectiveness, but clopidogrel is often chosen for stable coronary disease because of its relatively reduced bleeding risk.[18] The CRUSADE score, in conjunction with other validated risk assessment instruments, aids doctors in customizing antithrombotic therapies by balancing the risks of ischemia with bleeding considerations.[19]

Cilostazol may serve as an alternative to dual antiplatelet therapy NSTEMI patients with active gastrointestinal bleeding following percutaneous coronary intervention. Research suggests cilostazol's unique mechanism of action as a phosphodiesterase-3 inhibitor provides antiplatelet effects with potentially lower bleeding risk compared to traditional dual antiplatelet regimens.[20] Several studies, including the CILON-T and HOST-ASSURE trials, have demonstrated cilostazol's efficacy in preventing cardiovascular events while showing favorable bleeding profiles, though limited data exists specifically for actively bleeding patients post-PCI. This approach requires careful individualized risk assessment, as standard guidelines still recommend abbreviated dual antiplatelet in most high-bleeding-risk scenarios following acute coronary syndromes.[21,22]

In long-term post-PCI treatment, establishing the optimal duration of dual antiplatelet is a critical component of therapy. Recent data indicates that a shorter dual antiplatelet therapy regimen may have comparable effectiveness in avoiding cardiovascular events while markedly decreasing bleeding risks relative to an extended dual antiplatelet regimen.[23,24] This aspect is especially pertinent for individuals with elevated bleeding risk, since extended treatment may introduce more difficulties.[25] The DAPT score has become an essential instrument for stratifying patients according to their ischemia and hemorrhagic risks, assisting doctors in establishing the ideal length of treatment.[26] Nonetheless, despite guideline-based recommendations, real-world data indicate that adherence to dual antiplatelet therapy poses a challenge, as numerous patients terminate treatment prematurely, highlighting the necessity for ongoing patient education and prolonged follow-up to promote adherence and mitigate adverse cardiovascular events.[27]

4. Conclusion

A patient was assessed as non-ST elevation myocardial infarction and performed an invasive procedure and implanted drug eluting stent. He was recommended dual antiplatelet treatment. Nevertheless, he had gastrointestinal bleeding, having a prolonged history of NSAID use. Nonetheless, he had active gastrointestinal hemorrhaging, with endoscopy identifying the source of the bleeding in the stomach and intestines. The hemorrhaging was challenging to manage due to the existence of liver illness, even appropriate therapy.

5. Declaration

5.1 Ethics Approval and Consent to participate
Patient has provided written informed consent prior to involvement in the study.

5.2. Consent for publication
Not applicable.

5.3 Availibility of data and materials
Data used in our study were presented in the main text.

5.4 Competing interests
Not applicable.

5.5 Funding Source
Not applicable.

5.6 Authors contributions
Idea/concept: MA. Design: MA. Control/supervision: SR. Data collection/processing: MA. Analysis/interpretation: MA, SR. Literature review: MA, SR. Writing the article: MA. Critical review: SR

5.7 Acknowledgements
-

References

1. Hegazy MA, Mansour KS, Alzyat AM, Mohammad MA, Hegazy AA. Myocardial infarction: Risk factors, pathophysiology, classification, assessment and management. Cardiology Research and Reports 2022;4(5):1-11.doi: 10.31579/2692-9759/056.

2. Sabisi MA, Al-Shammari ZA. Major non-communicable diseases in Asia: Burden, epidemiological trends and projections, and future challenges. Narra Intern Med 2026;1(1):e7.doi: 10.52225/narraim.v1i1.6.

3. Maulana AS, Sargowo D, Rizal A, Martini H, Rohman MS, Rahimah AF, et al. The effect of garcinia mangostana linn extract to the levels of circulating endothelial cells and endothelial progenitor cells in patients with high framingham score. Heart Science Journal 2020;1(2):32-37.doi: 10.21776/ub.hsj.2020.001.02.6.

4. Byrne RA, Rossello X, Coughlan JJ, Barbato E, Berry C, Chieffo A, et al. 2023 ESC Guidelines for the management of acute coronary syndromes. Eur Heart J 2023;44(38):3720-3826.doi: 10.1093/eurheartj/ehad191.

5. Sorensen R, Hansen ML, Abildstrom SZ, Hvelplund A, Andersson C, Jorgensen C, et al. Risk of bleeding in patients with acute myocardial infarction treated with different combinations of aspirin, clopidogrel, and vitamin K antagonists in Denmark: a retrospective analysis of nationwide registry data. Lancet 2009;374(9706):1967-1974.doi: 10.1016/S0140-6736(09)61751-7.

6. Oktaviono Y. Current Insight on Percutaneous Coronary Intervention in Non-ST Elevation Acute Coronary Syndrome. Heart Science Journal 2024;5(3):1-3.doi: 10.21776/ub/hsj.2024.005.03.1.

7. Iwamoto J, Saito Y, Honda A, Matsuzaki Y. Clinical features of gastroduodenal injury associated with long-term low-dose aspirin therapy. World J Gastroenterol 2013;19(11):1673-1682.doi: 10.3748/wjg.v19.i11.1673.

8. Palmerini T, Sangiorgi D, Valgimigli M, Biondi-Zoccai G, Feres F, Abizaid A, et al. Short- versus long-term dual antiplatelet therapy after drug-eluting stent implantation: an individual patient data pairwise and network meta-analysis. J Am Coll Cardiol 2015;65(11):1092-1102.doi: 10.1016/j.jacc.2014.12.046.

9. Aziz M, Dasari CS, Zafar Y, Fatima R, Haghbin H, Alyousif ZA, et al. Does timing of endoscopy affect outcomes in patients with upper gastrointestinal bleeding: a systematic review and meta-analysis. European Journal of Gastroenterology & Hepatology 2021;33(8):1055-1062.doi.

10. Nozewski J, Grzesk G, Klopocka M, Wicinski M, Nicpon-Nozewska K, Konieczny J, et al. Management of Patient with Simultaneous Overt Gastrointestinal Bleeding and Myocardial Infarction with ST-Segment Elevation - Priority Endoscopy. Vasc Health Risk Manag 2021;17(1):123-133.doi: 10.2147/VHRM.S292253.

11. Committee ASoP, Acosta RD, Abraham NS, Chandrasekhara V, Chathadi KV, Early DS, et al. The management of antithrombotic agents for patients undergoing GI endoscopy. Gastrointest Endosc 2016;83(1):3-16.doi: 10.1016/j.gie.2015.09.035.

12. Larkai EN, Smith JL, Lidsky MD, Graham DY. Gastroduodenal mucosa and dyspeptic symptoms in arthritic patients during chronic nonsteroidal anti-inflammatory drug use. Am J Gastroenterol 1987;82(11):1153-1158.doi.

13. Yoshiji H, Nagoshi S, Akahane T, Asaoka Y, Ueno Y, Ogawa K, et al. Evidence-based clinical practice guidelines for Liver Cirrhosis 2020. J Gastroenterol 2021;56(7):593-619.doi: 10.1007/s00535-021-01788-x.

14. Northup PG, Garcia-Pagan JC, Garcia-Tsao G, Intagliata NM, Superina RA, Roberts LN, et al. Vascular Liver Disorders, Portal Vein Thrombosis, and Procedural Bleeding in Patients With Liver Disease: 2020 Practice Guidance by the American Association for the Study of Liver Diseases. Hepatology 2021;73(1):366-413.doi: 10.1002/hep.31646.

15. Costa F, van Klaveren D, James S, Heg D, Raber L, Feres F, et al. Derivation and validation of the predicting bleeding complications in patients undergoing stent implantation and subsequent dual antiplatelet therapy (PRECISE-DAPT) score: a pooled analysis of individual-patient datasets from clinical trials. Lancet 2017;389(10073):1025-1034.doi: 10.1016/S0140-6736(17)30397-5.

16. Verheugt FW, Steinhubl SR, Hamon M, Darius H, Steg PG, Valgimigli M, et al. Incidence, prognostic impact, and influence of antithrombotic therapy on access and nonaccess site bleeding in percutaneous coronary intervention. JACC Cardiovasc Interv 2011;4(2):191-197.doi: 10.1016/j.jcin.2010.10.011.

17. Kwok CS, Khan MA, Rao SV, Kinnaird T, Sperrin M, Buchan I, et al. Access and non-access site bleeding after percutaneous coronary intervention and risk of subsequent mortality and major adverse cardiovascular events: systematic review and meta-analysis. Circ Cardiovasc Interv 2015;8(4):e001645.doi: 10.1161/CIRCINTERVENTIONS.114.001645.

18. Aradi D, Storey RF, Komocsi A, Trenk D, Gulba D, Kiss RG, et al. Expert position paper on the role of platelet function testing in patients undergoing percutaneous coronary intervention. Eur Heart J 2014;35(4):209-215.doi: 10.1093/eurheartj/eht375.

19. Vavalle John P, Clare R, Chiswell K, Rao Sunil V, Petersen John L, Kleiman Neal S, et al. Prognostic Significance of Bleeding Location and Severity Among Patients With Acute Coronary Syndromes. JACC: Cardiovascular Interventions 2013;6(7):709-717.doi: 10.1016/j.jcin.2013.03.010.

20. Park KW, Park JJ, Lee SP, Oh IY, Suh JW, Yang HM, et al. Cilostazol attenuates on-treatment platelet reactivity in patients with CYP2C19 loss of function alleles receiving dual antiplatelet therapy: a genetic substudy of the CILON-T randomised controlled trial. Heart 2011;97(8):641-647.doi: 10.1136/hrt.2010.216499.

21. Tantry Udaya S, Bonello L, Aradi D, Price Matthew J, Jeong Y-H, Angiolillo Dominick J, et al. Consensus and Update on the Definition of On-Treatment Platelet Reactivity to Adenosine Diphosphate Associated With Ischemia and Bleeding. JACC 2013;62(24):2261-2273.doi: 10.1016/j.jacc.2013.07.101.

22. Levine GN, Bates ER, Bittl JA, Brindis RG, Fihn SD, Fleisher LA, et al. 2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients With Coronary Artery Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines: An Update of the 2011 ACCF/AHA/SCAI Guideline for Percutaneous Coronary Intervention, 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery, 2012 ACC/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease, 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction, 2014 AHA/ACC Guideline for the Management of Patients With Non-ST-Elevation Acute Coronary Syndromes, and 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. Circulation 2016;134(10):e123-e155.doi: 10.1161/CIR.0000000000000404.

23. Watanabe H, Domei T, Morimoto T, Natsuaki M, Shiomi H, Toyota T, et al. Effect of 1-Month Dual Antiplatelet Therapy Followed by Clopidogrel vs 12-Month Dual Antiplatelet Therapy on Cardiovascular and Bleeding Events in Patients Receiving PCI: The STOPDAPT-2 Randomized Clinical Trial. JAMA 2019;321(24):2414-2427.doi: 10.1001/jama.2019.8145.

24. Yoon YH, Park GM, Roh JH, Her SH, Lim SH, Kang TS, et al. Comparison of 6-Month and Prolonged Dual Antiplatelet Therapy after Percutaneous Coronary Intervention with Biodegradable Polymer Everolimus-Eluting Stent. Cardiol Res Pract 2022;2022(1):2914385.doi: 10.1155/2022/2914385.

25. Mezier A, Motreff P, Clerc JM, Bar O, Deballon R, Demicheli T, et al. Is the duration of dual antiplatelet therapy (DAPT) excessive in post-angioplasty in chronic coronary syndrome? Data from the France-PCI registry (2014-2019). Front Cardiovasc Med 2023;10(1):1106503.doi: 10.3389/fcvm.2023.1106503.

26. Sun C, Zhong L, Wu Y, Cao C, Guo D, Liu J, et al. Incorporation of Laboratory Test Biomarkers Into Dual Antiplatelet Therapy Score Improves Prediction of Ischemic and Bleeding Events in Post-percutaneous Coronary Intervention Patients. Front Cardiovasc Med 2022;9(1):834975.doi: 10.3389/fcvm.2022.834975.

27. Lee OH, Kim BK, Hong SJ, Kim S, Ahn CM, Shin DH, et al. Determinants and Clinical Outcomes of Extended Dual Antiplatelet Therapy over 3 Years after Drug-Eluting Stent Implantation: A Retrospective Analysis. Yonsei Med J 2020;61(7):597-605.doi: 10.3349/ymj.2020.61.7.597.