Review Article

Blood Coagulation Disorders in Heart Failure: From Basic Science to Clinical Perspectives

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ABSTRACT

Heart failure (HF) is a clinical syndrome that is divided into 3 subtypes based on the left ventricular ejection fraction. Every subtype has specific clinical characteristics and concomitant diseases, substantially increasing risk of thromboembolic complications, such as stroke, peripheral embolism and pulmonary embolism. Despite the annual prevalence of 1% and devastating clinical consequences, thromboembolic complications are not typically recognized as the leading problem in patients with HF, representing an underappreciated clinical challenge. Although the currently available data do not support routine anticoagulation in patients with HF and sinus rhythm, initial reports suggest that such strategy might be beneficial in a subset of patients at especially high thromboembolic risk. Considering the existing evidence gap, we aimed to review the currently available data regarding coagulation disorders in acute and chronic HF based on the insight from preclinical and clinical studies, to summarize the evidence regarding anticoagulation in HF in special-case scenarios and to outline future research directions so as to establish the optimal patient-tailored strategies for antiplatelet and anticoagulant therapy in HF. In summary, we highlight the top 10 pearls in the management of patients with HF and no other specific indications for oral anticoagulation therapy. Further studies are urgently needed to shed light on the pathophysiological role of platelet activation in HF and to evaluate whether antiplatelet or antithrombotic therapy could be beneficial in patients with HF.

Lay Summary: Heart failure (HF) is a clinical syndrome divided into 3 subtypes on the basis of the left ventricular systolic function. Every subtype has specific clinical characteristics and concomitant diseases, substantially increasing the risk of thromboembolic complications, such as stroke, peripheral embolism and pulmonary embolism. Despite the annual prevalence of 1% and devastating clinical consequences, thromboembolic complications are not typically recognized as the leading problem in patients with HF, representing an underappreciated clinical

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challenge. Although the currently available data do not support routine anticoagulation in patients with HF and no atrial arrhythmia, initial reports suggest that such a strategy might be beneficial in a subset of patients at especially high risk of thrombotic complications. Considering the existing evidence gap, we aimed to review the currently available data regarding coagulation problems in stable and unstable patients with HF based on the insight from preclinical and clinical studies, to summarize the evidence regarding anticoagulation in HF in specific patient groups and to outline future research directions to establish the optimal strategies for antiplatelet and anticoagulant therapy in HF, tailored to the needs of an individual patient. In summary, we highlight the top 10 pearls in the management of patients with HF and no other specific indications for oral anticoagulation therapy. (*J Cardiac Fail 2023;29:517−526*)

Heart failure (HF) is a clinical syndrome caused by a structural or functional disorder of the heart that results in elevated intracardiac pressures and/or inadequate cardiac output during exercise or rest,[1] and it has a worldwide prevalence of 1%−2%.[2] HF is divided into 3 subtypes, based on the left ventricular ejection fraction (LVEF): (1) HF with reduced ejection fraction (HFrEF); (2) HF with mildly reduced ejection fraction (HFmrEF); and (3) HF with preserved ejection fraction (HFpEF).[1] Every subtype has specific clinical characteristics and common concomitant diseases, including variable risk of thromboembolic complications. It also must be acknowledged that some experts consider LVEF in patients with HF as a continuum of left ventricular systolic dysfunction rather than a distinct clinical phenotype of specific subpopulations.[1]

Although thromboembolic complications are not typically recognized as the leading problem in patients with HF, HF is associated with substantial coagulation disorders.[3] For example, the incidence of stroke is higher in the first month following HF diagnosis or decompensation and decreases within 6 months following the acute event.[4] The prothrombotic phenotype in patients with HF might be due to (1) systemic inflammatory response induced by chronic hypoxia, (2) increased concentrations of prothrombotic molecules, or (3) arterial and venous endothelial dysfunction. Thus, increased risk of thromboembolic complications is a hallmark of HF and represents an underappreciated clinical challenge. Whereas thromboembolism prophylaxis by low-molecular-weight heparin is recommended for hospitalized patients with acute HF (AHF) in the absence of contraindications and in patients treated with long-term mechanic circulatory support,[1] the guidelines regarding the routine antithrombotic and/or anticoagulant treatment in patients with HF are controversial. Data from meta-analyses suggest that patients with HF and sinus rhythm (SR) treated with warfarin have double the risk of major bleeding but without significant increases in intracranial hemorrhage.[5] Nevertheless, the authors observed significant reductions in stroke risk but, finally, saw a lack of beneficial effects on all-cause mortality.[5] However, no such data are available for direct oral anticoagulants (DOACs). The only study that evaluated the efficacy and safety of DOACs (low-dose rivaroxaban twice daily) in patients with HFrEF, coronary artery disease (CAD) and SR did not show any benefit in terms of the composite endpoint of death, stroke or myocardial infarction (MI) compared with placebo.[6] However, a post hoc analysis of this study demonstrated that patients treated with rivaroxaban had a 32% lower incidence of the primary neurological endpoint (all-cause stroke or transient ischemic attack) compared with patients taking the placebo, without an increased rate of fatal bleeding or bleeding into a critical space.[4] Hence, although the currently available data do not support routine anticoagulation in patients with HF and SR, initial reports suggest that such a strategy might be beneficial in a subset of patients at especially high thromboembolic risk. Considering the existing evidence gap, we aimed to review the currently available data regarding coagulation disorders in acute and chronic HF (CHF) based on the insight of preclinical and clinical studies, to summarize the evidence regarding anticoagulation in HF in special-case scenarios and to outline future research directions so as to establish the optimal patient-tailored strategies for antiplatelet and anticoagulant therapy in HF. Here we summarize the known mechanisms underlying coagulation disorders in HF (Fig. 1).

Platelet Activation in Acute and Chronic Heart Failure

HF is associated with an increased risk of thromboembolism, regardless of the presence of atrial fibrillation (AF).[7] These coagulation disorders might be partially explained by the Virchow triad components (stasis of blood in peripheral circulation and heart chambers, hypercoagulability, endothelial dysfunction). However, the precise mechanisms underlying

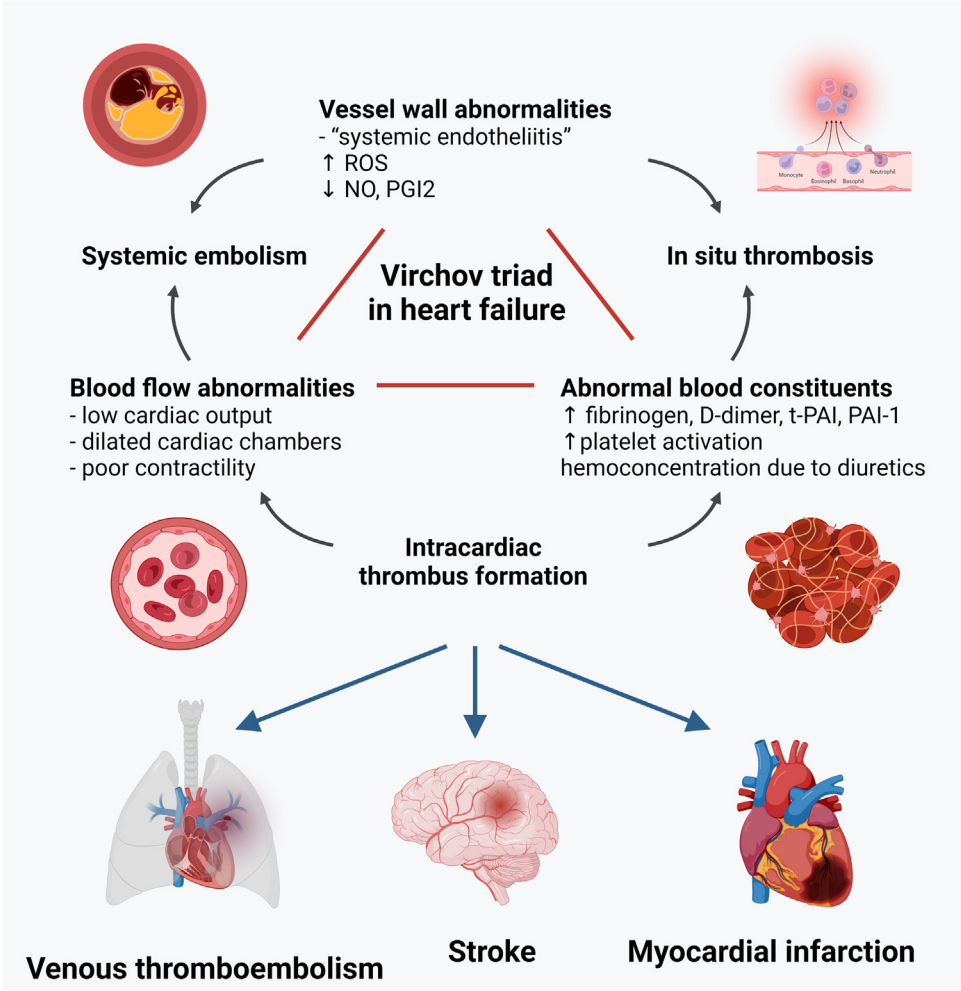

Fig. 1. Mechanisms underlying coagulation disorders in acute heart failure. NO, nitric oxide; PAI-1, plasminogen activator inhibitor-1; PGI2, prostaglandin I2; ROS, reactive oxygen species; t-PA, tissue plasminogen activator.

thrombosis in patients with HF and SR remain to be determined.[8]

Preclinical studies showed dysregulation of platelet-signaling pathways in HF, leading to platelet hyper-reactivity.[9] In patients with HF, elevated levels of platelet activation such as soluble P-selectin have been observed compared to healthy controls.[7] Adhesion proteins and platelet activation markers (CD63, CD40 ligand and P-selectin) were overexpressed in AHF compared to CHF.[7,10] The expression levels of these markers were reduced following initiation of treatment in patients with decompensated HF.[11] Moreover, platelet-leucocytes interactions, known to correlate with platelet activation and adverse events, were also higher in patients with HF.[12]

The mechanisms underlying platelet dysregulation in HF still need to be understood. For these reasons, platelets remain an unchallenged target in HF; few studies have attempted to investigate the roles of antiplatelet and antithrombotic therapies in this setting, and they all failed to demonstrate significant clinical benefits.[13–16]

Coagulation Disorders in Heart Failure Subtypes

The pathophysiology of coagulation disorders in various CHF subtypes is summarized in the Visual Take-Home Graphic (Fig. 2).

Increased thromboembolic risk in patients with HFrEF was demonstrated in numerous studies, as indicated by (1) prothrombotic plasma profiles, (2) higher rates of thromboembolic complications and (3) risks of left ventricle (LV) thrombus. Patients with HFrEF have substantially increased thromboembolic risk due to unfavorable fibrin-clot properties compared to healthy controls.[17] Thromboembolic complications in patients with HFrEF include stroke, peripheral embolism and pulmonary embolism. In the randomized controlled Sudden Cardiac Death in

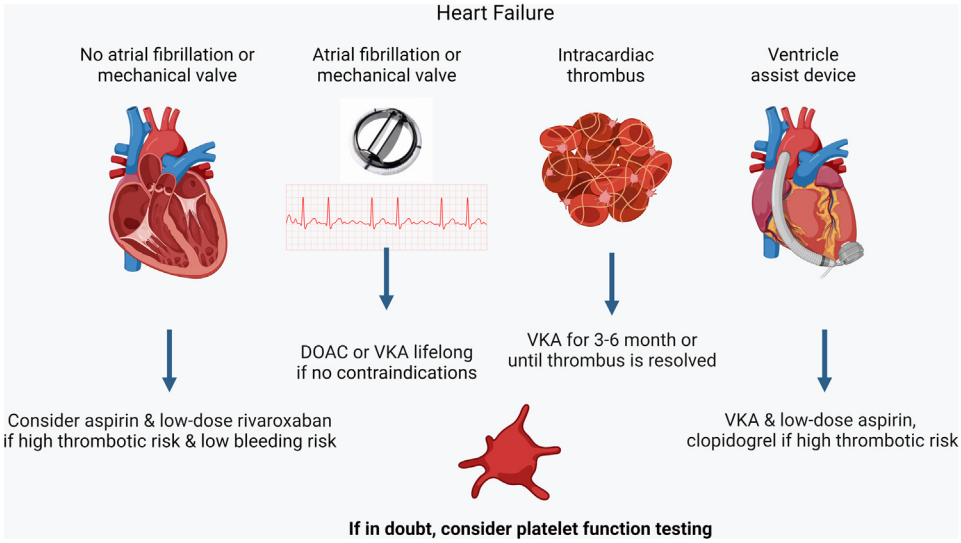

Fig. 2. Visual Take Home Graphic. Pathophysiology of coagulation disorders in various heart failure subtypes. CABG, coronary artery bypass grafting; LV, left ventricle; MI, myocardial infarction; PCI, percutaneous coronary intervention.

Heart Failure Trial (SCD-HeFT), patients with HFrEF experienced thromboembolism at an annual rate of 1.0%, with the higher risk associated with lower LVEF.[18] Based on the retrospective analysis of the Studies of Left Ventricular Dysfunction (SOLVD), a decline in LVEF was associated with thromboembolic risk in women, with a relative risk of 1.53 with every 10% decrease of LVEF.[19] Similarly, in the Survival and Ventricular Enlargement (SAVE) trial, the authors showed an 18% increase in stroke risk for every 5% reduction in the LVEF.[20] LV thrombus is another possible complication of HFrEF, present in 2.1% to 7.0% of patients. The predisposing factors include severe systolic dysfunction, ischemic HF etiology and akinesis of the apex and anterior walls.[21,22] Patients with an LV thrombus have 4-fold higher risk of thromboembolism and 2-fold higher risk of long-term mortality, and anticoagulation is a standard-of-care in these patients.[1,22]

Regarding HFmrEF, the Practice Innovation and Clinical Excellence (PINNACLE) Registry showed that these patients were more likely to have AF, type 2 diabetes and chronic kidney disease and to have histories of tobacco use compared to those with HFrEF.[23] The authors also found that patients with HFmrEF had distinct atherothrombotic profiles, including histories of CAD, prior MI or percutaneous coronary interventions.[23] Interestingly, due to this specific clinical profile of patients with HFmrEF, the authors hypothesized that the antithrombotic therapy with rivaroxaban, which did not improve outcomes in patients with HFrEF, might be beneficial in patients with HFmrEF.[6,23]

Thromboembolic risk in patients with HFpEF is associated with a higher prevalence of AF compared to other HF subtypes.[24] In addition, patients with HFpEF have many other cardiovascular and noncardiovascular comorbidities that indirectly increase the risk of thrombotic complications, such as chronic kidney disease, arterial hypertension and type 2 diabetes.

Despite the substantially higher risk of thromboembolic complications, currently, no evidence supports the routine use of anticoagulation in patients with HF and SR.[8,24] Nevertheless, no specific randomized clinical trials have been conducted in the subgroups of patients at very high thromboembolic risk, such as patients with HFrEF $<$ 20% and/or akinesis of the apex. There are only few observational, retrospective data concerning this topic of interest and demonstrating promising results in the resolution of left ventricular thrombus (REF). More robust data regarding the potentially lower rates of stroke or other thromboembolic events due to anticoagulation in this challenging patient subgroup are urgently needed.

Anticoagulation for Heart Failure in Special Pathophysiological Settings

Patients With Heart Failure With and Without Atrial Fibrillation

The risks of systemic thromboembolism and ischemic stroke are common in HFrEF due to impaired LV systolic function. Moreover, these events are associated with devastating clinical consequences, regardless of the presence or absence of AF.[25]

Contemporary data show that 47.5% of first-time strokes in patients with HFrEF are either severely disabling or fatal.[4] Although the efficacy of

anticoagulants in HF for concurrent comorbidities such as AF is well established, data on the routine use of anticoagulants in patients with chronic HF and SR have been conflicting. For example, pioneering data derived from the Warfarin and Antiplatelet Therapy in Chronic Heart Failure (WATCH) trial, conducted in patients with HFrEF in SR, showed that warfarin use was not superior to aspirin or clopidogrel regarding reduction in the primary outcome of death, nonfatal MI or nonfatal stroke.[15] In this trial, warfarin use was associated with fewer nonfatal stroke events, but this was offset by the higher number of major hemorrhages and central nervous system bleeding events. Similar findings were found in the Warfarin versus Aspirin in Reduced Cardiac Ejection Fraction (WARCEF) trial, demonstrating that the reduced risk of ischemic stroke with the use of warfarin in patients with HFrEF and SR was outweighed by an increased risk of major bleeding.[16] Due to the increasing prevalence of the use of DOACs for thromboembolism prevention, it remains unclear whether the use of DOACs in the setting of HF and SR would provide a more favorable risk-benefit profile compared to vitamin K antagonists (VKAs).

The seminal Cardiovascular Outcomes for People Using Anticoagulation Strategies (COMPASS) trial was undertaken to determine whether the addition of low-dose DOAC (2.5 mg of rivaroxaban twice daily) to aspirin in patients with stable atherosclerotic disease would mitigate the risks of major adverse cardiovascular events, with an acceptable margin of bleeding events, compared to aspirin alone. This trial showed that the combined use of low-dose rivaroxaban and aspirin was associated with a 24% relative risk reduction of adverse cardiovascular outcomes; however, this effect was countered by the 70% increase in the relative risk of major bleeding events.[26] Subanalysis of this large trial showed that the effect of concomitant use of rivaroxaban and aspirin achieved a similar reduction in major adverse cardiovascular events in patients with and without HF; however, the magnitude of treatment benefit was higher in patients with HF.[27] The observed benefit was similar in patients with LVEF $<$ 40% and those with LVEF $\geq$ 40%; the excess bleeding was not different in patients with and without HF. The authors observed a 36% increase in the relative risk of major bleeding in patients with HF and SR who were treated with rivaroxaban, but this increase was not statistically significant.

The issue of anticoagulation in patients with exacerbated HF, concomitant CAD and without AF was investigated in the Study to Assess the Effectiveness and Safety of Rivaroxaban in Reducing the Risk of Death, Myocardial Infarction, or Stroke in Participants with Heart Failure and Coronary Artery Disease Following an Episode of Decompensated Heart Failure (COMMANDER HF) trial, which enroled 5022 patients.[6] The results of this trial were disappointing because the "vascular dose" of rivaroxaban (2.5 mg twice daily, based on the COMPASS trial) added to the standard of care failed to reduce rates of death, MI or stroke, compared to placebo. The post hoc analysis of this trial showed that thromboembolic events are common in this population and that rivaroxaban significantly reduced the rate of thromboembolism (about 20% of relative risk reduction); however, these events were not the principal drivers of mortality and morbidity in this population, thus were unaffected by rivaroxaban.[28] Although current European and U.S. guidelines recommend the use of OACs in patients with HFrEF and concomitant AF and/or mechanical valves, no recommendations are made for patients with HF and SR due to the lack of benefit in morbidity and mortality rates.[1,29] However, low-dose rivaroxaban alongside aspirin is an option for patients with high-risk chronic coronary syndrome and without high bleeding risk, including those with HF.

Altogether, current data do not support the prophylactic use of OAC in patients with HFrEF and SR in the absence of left ventricular thrombus. However, addition of low-dose rivaroxaban might be considered in selected cases, for example, among patients with HF in SR who also have established CAD and/or peripheral artery disease and are at low risk of bleeding but at high risk of recurrent ischemic events.[1]

Patients With Heart Failure and Left Ventricular Thrombus

The formation of LV thrombus is a consequence of depressed LV systolic function due to various etiologies, such as a large anterior or apical MI with an extensive scar or aneurysm formation, nonischemic dilated cardiomyopathy and/or chronic severe HFrEF. The thrombus formation in the LV is precipitated by relative blood stasis in hypokinetic cardiac chambers; prothrombotic blood phenotype is 1 of the characteristics of patients with HFrEF per se.[30] Therefore, at least 2 components of the Virchow triad of thrombogenesis are operative in HFrEF, often complemented by the component of endothelial injury. However, there are no robust randomized data informing clinical practice about the use of anticoagulants in patients with HF and LV thrombus when they have no other indications of anticoagulation. There is a substantial prevalence of LV thrombus in HF, but the incidence of thromboembolic events remains low, thus questioning the practice of routine systemic anticoagulation in this setting.[31] The latest guidelines recommend considering systemic anticoagulation in patients with HF and

intraventricular thrombus, regardless of the underlying rhythm.[1] On the other hand, U.S. guidelines acknowledge the small benefit of anticoagulation in patients with HFrEF and SR in patients with severely depressed systolic function and evidence of intracardiac thrombi.[29] International guidelines focused on stroke prevention and acute ST-elevation MI management generally recommend 3−6 months of OAC with warfarin in patients with visible intracardiac thrombus or until the thrombus has resolved.[32,33]

No randomized data exist concerning the efficacy and safety of DOACs vs warfarin in the treatment of LV thrombus, although observational data and meta-analyses suggest noninferiority or even superiority of DOACs vs warfarin with respect to thrombus resolution and safety profile.[34,35] Contrary to this, there are data showing the inferiority of DOACs in preventing stroke or systemic embolism in patients with LV thrombus when DOACs are compared to warfarin.[36] A recent state-of-the-art review of LV thrombus recommended the use of VKA with the goal of an international normalized ratio of 2−3 in LV thrombus, and DOACs should be used if VKA cannot be tolerated.[37]

In conclusion, no specific guidelines and trials exist concerning the use of anticoagulation in the setting of HF and concomitant LV thrombus in the absence of other prothrombotic conditions, and most of such practices are based on extrapolation of data from other settings such as anticoagulants. Nevertheless, it is common practice to start anticoagulation treatment after diagnosis of LV thrombus and to continue it for 3−6 months or until the thrombus resolution is confirmed by cardiac imaging. Due to the unresolved question of whether DOACs are equivalent to or better than warfarin in treating LV thrombus, the choice of anticoagulation agent in this setting remains a question of scientific debate, and the anticoagulation should be selected on an individual case-by-case basis, but guidelines generally continue to endorse VKA as the first choice.

Patients Treated With Mechanical Circulatory Support and Left Ventricular Assist Devices

Patients treated with mechanical circulatory support (MCS), for example, extracorporeal membrane oxygenation (ECMO) or a left ventricular assist device (LVAD), are at particular risk of thrombosis for a number of reasons.

Mechanical Circulatory Support. The thrombotic response can be initiated by blood coming into contact with an artificial surface via activation of the intrinsic pathway and by adherence of platelets and leucocytes, which then release prothrombotic factors locally.[38] Nonphysiological levels of shear stress can also trigger thrombosis. This can predominantly activate the coagulation cascade and/or platelets, depending on the specific conditions.[39] It is, therefore, rational to consider antithrombotic therapy during MCS. However, as well as an elevated risk of thrombosis, patients receiving MCS also have an increased incidence of bleeding events, some associated directly with the MCS technology but others with a seemingly unrelated elevated background risk.[40] Balancing these risks is challenging but continues to favor a high intensity of prophylactic treatment.[41] Current recommendations for long-term MCS suggest initiating postoperative parenteral anticoagulation, typically with unfractionated heparin, as long as bleeding is controlled.

Left Ventricular Assist Devices. In the case of LVADs, once the patient is clinically stable, oral anticoagulation for the duration of circulatory support is recommended. The agent of choice remains a VKA such as warfarin, with a target international normalized ratio of 2.0−3.0. Largely due to a paucity of data, treatment with a DOAC is not recommended in patients with LVADs.[42] Alongside anticoagulation, routine low-dose aspirin is recommended to reduce thrombotic complications.[43] In some cases of particularly high thrombotic risk or when implanting certain devices such as the HeartWare system (though now discontinued), it has been recommended to confirm good response to aspirin and, optionally, add a second antiplatelet drug, such as dipyridamole or clopidogrel.[44]

In the case of ECMO, it has been questioned whether, with current-generation equipment, including heparin-coated circuits, therapeutic levels of anticoagulation are necessary. A systematic review of 34 studies including 201 patients suggested that anticoagulant-free ECMO had rate of circuit and patient thrombosis similar to that of continuous systemic anticoagulation. Nevertheless, this review was limited by a retrospective design, inconsistent reporting of outcomes and a relatively small sample size.[40] In daily clinical practice, systemic anticoagulation remains a standard of care in patients treated with ECMO. Several small-scale studies of lower-intensity regimens of anticoagulation are underway (eg, RATE, NCT04536272; SAFE-ECMO, NCT04997265).

Patients After Heart Transplantation

Patients with HF who have undergone cardiac transplantation represent another challenging group regarding optimal antithrombotic strategies. Transplant-specific reasons, such as increased long-term risks of malignancy, infection and chronic kidney disease due to immunosuppression, contribute to bleeding risk, whereas the proinflammatory

milieu of acute or chronic rejection increases the risk of thrombosis.[45]

Antithrombotic therapy may be complicated by metabolic interactions of drugs such as VKAs, NOACs and ticagrelor with the calcineurin inhibitors cyclosporin and tacrolimus.[46] Cardiac transplant recipients may have less response to aspirin than other groups and in transplant patients with evidence of vasculopathy compared to those without it.[47]

There are no data supporting the routine use of antithrombotic therapy after cardiac transplantation. The cornerstones of management are to continue long-term antithrombotic therapy if it was indicated pretransplant (eg, for chronic coronary syndromes, representing a raised baseline ischemic risk due to CAD itself) and to treat post-transplant thrombotic events as they arise. A common complication of cardiac transplantation is cardiac allograft vasculopathy (CAV), a manifestation of chronic rejection mediated by platelet, immune and endothelial activation.[48] Antiplatelet therapy might reduce the development or sequelae of CAV. Studies that examined whether aspirin might impact the development of CAV after cardiac transplantation did not provide solid evidence of any beneficial effects of such therapy.[49]

There is no evidence that routine therapeutic anticoagulation without a clear indication after heart transplantation is beneficial. OAC is indicated in cases of AF or venous thromboembolism (VTE), but there is only limited information regarding the choice of OAC. The use of a NOAC may lead to less bleeding than a VKA, consistent with general findings.[50] Whether these drugs provide the same degree of thrombotic protection in patients with heart transplant remains unexplored.

Recommendations for Anticoagulation in Heart Failure and Future Studies

In this article we aimed to review the available literature to summarize the current management of anticoagulation in patients with HF. We want to emphasize that HF should be recognized as a risk factor for thromboembolic events, of which stroke is 1 of the most severe. In summary, we highlight the top 10 pearls in the management of patients with HF and no other specific indications for OAC therapy (Table 1).

HF is associated with an increased risk of thromboembolism regardless of the presence of AF. Both platelet activation and coagulation system abnormalities may be responsible for the increased risk of major thromboembolic events in patients with HF. Although recent antithrombotic and antiplatelet clinical trials failed to demonstrate significant clinical benefits of OACs in comparison to aspirin or placebo in the overall population of patients with HF, a post hoc analysis of the COMMANDER-HF study demonstrated a significantly lower incidence of the primary neurological endpoint in patients with HFrEF who were treated with rivaroxaban and without increased rates of major bleeding. Although routine anticoagulation in patients with HF and SR cannot be recommended, it remains important to search actively for AF and other indications for OACs in patients with HF, to accelerate diagnosis and to optimize treatment of thromboembolic risk factors.

Patients with HFrEF experience thromboembolism at the annual rate of 1.0%. A decrease in LVEF correlates positively with an increase in thromboembolic risk, with the highest risk occurring in patients with LVEF $<$ 20% and akinesis of the apex and apical LV segments, predisposing them to LV thrombus formation. Patients with an LV thrombus have 4-fold higher risk of thromboembolism and 2-fold higher risk of long-term mortality and should be considered for anticoagulation. Moreover, observational data

Table 1. Top 10 Pearls in the Management of Patients With HF and no Other Indications for Oral Anticoagulation

1. The population with heart failure (HF) is at high risk for thromboembolic events.
2. Recent clinical trials failed to demonstrate significant benefits of antithrombotic therapy in the overall HF population but without an alternative indication.
3. Atrial fibrillation (AF) in patients with HF should be meticulously ruled out and, if it exists (if there are no contraindications), should be treated with a proper anticoagulation regimen.
4. In HF with reduced ejection fraction (EF), a decrease in EF positively correlates with an increase in thromboembolic risk.
5. Patients with acute HF should be considered for prophylactic anticoagulation during hospitalization to prevent venous thromboembolism. The benefits of long-term anticoagulation following an acute episode have not been demonstrated.
6. Left ventricle thrombus is associated with around a 4-fold increase risk of thromboembolism and a 2-fold higher risk of mortality. Anticoagulation is recommended in this setting. Most current guidelines continue to favor vitamin K antagonists over non-vitamin K antagonist OACs, but more studies are urgently needed in this area.
7. HF with preserved EF ejection fraction is often associated with a mosaic of clinical comorbidities, which should be taken into account when assessing the global thromboembolic risk.
8. Patients with HF should receive antiplatelet therapy if there is an additional indication, such as prior myocardial infarction or coronary revascularization. Assessment of both ischemic and bleeding risk should be performed in patients with HF requiring antiplatelet therapy to determine the correct intensity of treatment.
9. Patients treated with mechanical circulatory support or heart transplantation represent particular challenges, and the optimal antithrombotic regimen should be tailored to the individual patient after considering ischemic and bleeding risks.
10. HF is a dynamic condition, and indications for antithrombotic treatment may change over time. Frequent reevaluation is key to optimizing outcomes.

indicate that the use of clinical scores such as CHA_2DS_2-VASc might help to estimate the thromboembolic risk in patients with HF (HFrEF and HFmrEF) and SR. On the other hand, HFpEF is mosaic of various patient populations and their clinical characteristics, which carry additional risks for both thrombosis and bleeding. Therefore, choosing the optimal pharmacotherapy and examining the potential benefits of OACs are far more challenging. The most common comorbidities, which are described in detail in separate subparagraphs, should be taken into account when assessing the global thromboembolic risk in patients with HFpEF.

On the other hand, thromboembolic prophylaxis (eg, with low molecular weight heparin) is recommended in patients with AHF who do not have specific indications for anticoagulation and have no contraindications to anticoagulation therapy so as to reduce the risk of venous thromboembolism and pulmonary embolism. However, the benefits of long-term anticoagulation following an AHF episode have not been demonstrated.

Although not routinely recommended, anticoagulation might be beneficial in specific clinical scenarios frequently met in general practice, such as ACs, AF and after transcatheter aortic valve implantation, during MCS/ECMO, or after heart transplantation. In these subpopulations, the optimal antithrombotic/antiplatelet therapy should be tailored to the individual patient, based on the medical history and thromboembolic risk.

Proposed Social Media Text

Thrombotic complications in patients with heart failure—an underappreciated challenge! The authors discuss data regarding coagulation disorders in acute and chronic heart failure, scenarios where antiplatelet and anticoagulant therapy can be tailored and provide top 10 pearls in coagulation disorders management in heart failure.

Disclosures

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