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Education Article

Fine Lines and Thin Margins: Nutritional and Anticoagulation Challenges in Long-Term Mechanical Circulatory Support

Jelena R. Stefanović Nešković[1], Branimir D. Nešković[2], Evgenija D. Strugarević[3]

[1] Heart Failure Center, Institute for Cardiovascular Diseases Dedinje, Belgrade, Serbia,
[2] Clinic for General Surgery, Military Medical Academy, Belgrade, Serbia
[3] Transfusion Department, Institute for Cardiovascular Diseases Dedinje, Belgrade, Serbia

SUMMARY

Introduction: Patients receiving long-term mechanical circulatory support (MCS), including Left Ventricular Assist Device (LVAD) and total artificial heart (TAH), represent a high-risk population prone to thromboembolic and bleeding complications. Stable anticoagulation is essential, as even minor INR fluctuations may result in severe consequences. Warfarin and acenocoumarol require consistent vitamin K intake and careful monitoring of food interactions, herbal supplements, and fruit juices.

Methodology: This article is based on review and synthesis of relevant published studies, clinical guidelines, and expert recommendations.

Topic: A stable and predictable intake of vitamin K reduces INR variability, while sudden dietary changes increase the risk of bleeding or thrombosis. Herbal supplements and spices – such as garlic, ginger, turmeric, *Ginkgo biloba*, as wll as alcohol, and certain fruit juices (e.g. grapefruit, cranberry) may destabilize INR. Patient education, individualized nutritional planning, and multidisciplinary supervision are essential to maintain anticoagulation stability.

Conclusion: Consistent vitamin K intake, careful management of supplements and spices, patient education, and coordinated multidisciplinary supervision contribute to stable anticoagulation, reduce complication risks, and improve quality of life in patients with long-term MCS.

Keywords: Warfarin, Acenocoumarol, Food Interactions, Vitamin K, Anticoagulant Therapy, INR, Clinical Practice

INTRODUCTION

In patients with terminal heart disease, long-term mechanical circulatory support (MCS) using LVAD (Left Ventricular Assist Device) or TAH (Total Artificial Heart) provides prolonged circulatory support aimed at improving survival and quality of life.

Maintaining stable anticoagulation remains a major clinical challenge, as even small fluctuations in INR can result in serious complications, ranging from device thrombo-

Corresponding author:
Evgenija D. Strugarević, MD
Clinical Transfusion Medicine Specialist and Specialist in Medical Management
Transfusion Department, Institute for Cardiovascular Diseases Dedinje, Prote Mateje 63, Belgrade, Serbia
E-mail: evgenijastrugarevic@yahoo.com

sis to spontaneous bleeding [1, 2].

Although warfarin and acenocoumarol differ in pharmacokinetics, the core principles of anticoagulation management remain unchanged. These include ensuring a consistent daily intake of vitamin K is important, careful monitoring of supplements and seasonings, and thorough patient education.

This review aims to provide practical and clinically relevant guidance for patients with mechanical circulatory support, in order to optimize anticoagulation safety and stability, minimize the risk of complications, and emphasize the importance of a multidisciplinary and individualized approach.

Warfarin and acenocoumarol are vitamin K antagonists that inhibit the enzyme vitamin K epoxide reductase (VKOR), which is essential for the regeneration of active vitamin K. Active vitamin K is required for the post-translational γ-carboxylation of coagulation factors II, VII, IX, and X, as well as anticoagulant proteins C and S [3].

Without adequate activation of these factors normal coagulation cannot occur, resulting in impaired coagulation and a predisposition to bleeding.

The main difference between the two drugs lies in their pharmacokinetics. Warfarin, with its longer half-life, exhibits a slower onset of action and provides more stable INR levels, even with minor dietary variations. In contrast, acenocoumarol, has a shorter half-life, acts more rapidly but is more sensitive to sudden changes in vitamin K intake, herbal supplements, or certain juices, requiring greater vigilance in patients on long-term mechanical circulatory support [4].

METHODOLOGY

This article is based on a review and synthesis of relevant published studies, clinical guidelines, and expert recommendations.

TOPIC

Patients receiving long-term mechanical circulatory support (MCS) require meticulous management of vitamin K and other nutrients, as these can significantly influence the pharmacodynamics of vitamin K antagonists.

The primary therapeutic objective is to maintain the INR within the target range, ensuring effective anticoagulation without increasing bleeding risk. Diet plays a crucial role in achieving INR stability, as food can modify both the pharmacodynamic activity and pharmacokinetics of vitamin K antagonists [5].

The influence of diet on vitamin K antagonist therapy is multifactorial and highly individualized. While vitamin K is the most recognized factor capable of reducing drug effect, INR fluctuations often result from a combination of factors, including genetic predisposition and comorbid conditions [6,7,8].

A predictable and consistent intake of dietary vitamin K is more important than strict restriction, as sudden changes can trigger significantINR fluctuations. Complete avoidance of green leafy vegetables may lead to vitamin K deficiency, which reduces the synthesis of coagulation factors, increases INR, and predisposes patients to spontaneous bleeding, including bruising, epistaxis, gastrointestinal hemorrhage, and even serious intracranial bleeding [9].

In the long term, vitamin K deficiency can also compromise bone health, as vitamin K is essential for the carboxylation of osteocalcin, a protein necessary for bone mineralization.

Insufficient vitamin K impairs skeletal integrity, contributing to osteoporosis and an increased fracture risk [10].

Even modest, consistent vitamin K intake supports anticoagulation stability and reduces complication risk. Vegetables rich in vitamin K, such as spinach, kale, or broccoli, can diminish drug effect if consumed in variable amounts; therefore, a stable, evenly distributed intake across meals is crucial to maintain INR within the target range [11].

Clinical practice generally recommends approximately one to two handfuls of green leafy vegetables daily, divided among meals.

Herbal supplements and spices, including garlic, ginger, turmeric, and Ginkgo biloba, may enhance the anticoagulant effect, increasing bleeding risk. Conversely, certain products, such as soy, can reduce anticoagulant efficacy, leading to decreased INR and potential thromboembolic complications [12,13,14].

Alcohol [15,16] and certain fruit juices, particularly grapefruit [13] and cranberry, may further destabilize INR, which is particularly critical in patients on long-term MCS.

Practical application of these findings requires patient education, multidisciplinary

Category Details	Recommendations
Vitamin K-rich vegetables	Spinach, kale, broccoli. Can reduce drug effect if intake varies. Maintain a consistent daily intake, distributed across meals.
Enhances anticoagulant effect	Garlic, ginger, turmeric, Ginkgo biloba. Risk of bleeding. Use in moderate, consistent amounts and monitor INR.
INR fluctuations	Alcohol and juices (especially grapefruit and cranberry). Limit or avoid, and monitor INR closely.
Maintains stable INR effect	Whole grains, fruits, and moderate protein intake.

Table 1. Recommendations for Nutritional and Supplement Management in MCS Patients

Practical dietary and supplement recommendations for patients on long-term MCS aimed at stabilizing INR and reducing thromboembolic and bleeding risks.

supervision, and individualized therapy. Consistent meals with controlled vitamin K intake, along with careful introduction or avoidance of supplements and spices, form the foundation of a safe and effective anticoagulant regimen.

CONCLUSION

Achieving and maintaining stable anticoagulation in patients receiving long-term mechanical circulatory support (MCS) presents a significant clinical challenge, yet is attainable with careful management. Consistent vitamin K intake, meticulous monitoring of herbal supplements and spices, patient education, and multidisciplinary supervision constitute essential components of a comprehensive management strategy to mitigate thromboembolic and hemorrhagic risks.

Implementation of these principles not only enhances patient safety but also provides clinicians and dietitians with an evidence-based framework for anticoagulation management. Consequently, patients with mechanical circulatory support can maintain an improved quality of life while substantially lowering the incidence of adverse complications.

CONFLICT OF INTEREST

All authors declare no conflict of interest.

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Suptilne granice: Izazovi u ishrani i antikoagulacionoj terapiji kod bolesnika sa dugotrajnom mehaničkom potporom

Jelena R. Stefanović Nešković[1], Branimir D. Nešković[2], Evgenija D. Strugarević[3]

[1] Centar za srčanu slabost, Institut za kardiovaskularne bolesti Dedinje, Beograd, Srbija
[2] Klinika za opštu hirugiju, Vojnomedicinska akademija, Beograd, Srbija
[3] Služba za transfuziologiju, Institut za kardiovaskularne bolesti Dedinje, Beograd, Srbija

KRATAK SADRŽAJ

Uvod: Bolesnici sa dugotrajnom mehaničkom potporom cirkulacije (MCS), uključujući mehaničku pumpu za pomoć levoj srčanoj komori (LVAD) i totalno veštačko srce (TAH), predstavljaju visokorizičnu populaciju zbog sklonosti tromboembolijskim i hemoragijskim komplikacijama. Stabilna antikoagulacija je ključna, jer i male oscilacije INR mogu izazvati ozbiljne posledice. Varfarin i acenokumarol zahtevaju dosledan unos vitamina K i pažljivo praćenje interakcija sa hranom, biljnim suplementima i sokovima.
Metodologija: Rad predstavlja pregled relevantne literature, kliničkih studija i stručnih preporuka.
Tema: Stabilan i predvidiv unos vitamina K smanjuje varijabilnost INR, dok nagle promene povećavaju rizik od krvarenja i tromboze. Biljni suplementi i začini (beli luk, đumbir, kurkuma, Ginkgo biloba), alkohol i sokovi (grejpfrut, brusnica) mogu destabilizovati INR. Edukacija bolesnika, individualizovan pristup i multidisciplinarni nadzor su ključni za očuvanje stabilnosti antikoagulacije.
Zaključak: Dosledan unos vitamina K, pažljivo upravljanje suplementima i začinima, edukacija bolesnika i multidisciplinarni nadzor omogućavaju stabilnu antikoagulaciju, smanjuju rizik od komplikacija i poboljšavaju kvalitet života bolesnika sa MCS.

Ključne reči: varfarin, acenokumarol, interakcije sa hranom, vitamin K, antikoagulantna terapija, INR, klinička praksa

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