



Application of CDSS algorithm to adjust warfarin dose in patients undergoing mechanical valve replacement surgery

Mohamadreza Abedzadeh
Trauma Nursing Research Center, Kashan
University of Medical Sciences, Kashan, Iran.

Mohammad Moin Tootestani
,Student Research committe, Department of
Nursing,kashan Branch,Islamic Azad
university,Kashan,Iran

Tina Joshaghani
Student Research committe, Department of Nursing,kashan Branch,Islamic Azad university,Kashan,Iran

Abstract

The management of warfarin therapy presents clinical challenges due to its narrow therapeutic index. Adjusting the warfarin dose is done more accurately using data such as blood tests, INR, age, etc. Therefore, warfarin dose prediction requires an algorithm that can handle individual differences in addition to the ability to consider clinical factors. Artificial intelligence capabilities can be used for this purpose.

CDSS (clinical decision support systems) can be mentioned among the effective algorithms in this matter. This system reduces the average error in adjusting the dose of warfarin to one-eighth of the tablet. Therefore, the use of CDSS can increase the capacity to provide services in compliance with clinical guidelines and protocols and reduce the amount of medication errors and the use of care.

Keywords warfarin, CDSS, Dose adjustment, Artificial intelligence, AI.

Introduction

Warfarin is one of the most commonly used drugs for heart patients, which is prescribed as an anti-coagulant drug in heart diseases, especially artificial heart valve replacement.

The narrow range between the therapeutic and toxic levels of warfarin makes adjusting the dose of this drug complicated.

Many factors such as the level of blood tests, especially INR, age, gender, diet, co-morbidities, use of concurrent drugs and genetics affect the dose of warfarin. Therefore, warfarin dose prediction needs an algorithm that can manage individual differences in addition to the ability to consider clinical factors. For this purpose, the capabilities of artificial intelligence can be used.

CDSS (Clinical Decision Support Systems) can be mentioned among the effective algorithms in this matter.

CDSS includes software that, after receiving the required data, suggests the best possible decisions to the medical staff and prevents errors.

By using CDSS, which includes the patients' drug information, the results of their tests, as well as demographic information, a more accurate decision can be made regarding the adjustment of the warfarin dose.

The used models of CDSS are regression, Bayesian network (the system relating diseases to their symptoms), fuzzy logic (recreating the ability of the human mind and making logical decisions in ambiguous situations), artificial neural network, and evolutionary learning, which are the outputs of these methods. It has been mostly similar.

Search Strategy:

The present study was a systematic review conducted in [2024](#). This review study was conducted by searching the keywords artificial intelligence, warfarin, CDSS, Dose adjustment, in Scopus, PubMed, Web of science databases and also in Google [Scholar](#). After applying the inclusion and exclusion criteria, 5 articles in 2015-2024 were finally included in the study.

Results Discussion

According to the findings, the average error is less than one-eighth of a pill (0.625 mg) per day, which can be ignored from the point of view of doctors up to 1.25 mg per day.

It is also possible to reduce up to 95% of side effects caused by drug-test interactions by using these computer systems.

Conclusions

It can be expected that the implementation of CDSS for warfarin dose estimation will lead to the improvement of the quality of warfarin dose adjustment and the reduction of drug side effects caused by its use in patients undergoing mechanical heart valve replacement surgery. Also, the use of CDSS can increase the capacity to provide services adhering to clinical guidelines and protocols and reduce the rate of medication errors and the use of care.

References

- [1] Jing X, Min H, Gong Y, Biondich P, Robinson D, Law T, et al. Ontologies applied in clinical decision support system rules: Systematic review. *JMIR medical informatics*. 2023;11:e43053.
- [2] Setoudegan M, Ayani S, Akbarzadeh M, Shekarchi S, Nasiri S. Developing a clinical decision support system for prediction of warfarin dosage based on computer-interpretable guideline. *Journal of Health Administration*. 2022;25(3):125-48.
- [3] Yang J-Y, Shu K-H, Peng Y-S, Hsu S-P, Chiu Y-L, Pai M-F, et al. Physician compliance with a computerized clinical decision support system for anemia management of patients with end-stage kidney disease on hemodialysis: retrospective electronic health record observational study. *JMIR Formative Research*. 2023;7(1):e44373.
- [4] Dhippayom T, Boonpattharatthiti K, Kategeaw W, Hong H, Chaiyakunapruk N, Barnes GD, et al. Comparative effectiveness of warfarin management strategies: a systematic review and network meta-analysis. *EClinicalMedicine*. 2024;74.
- [5] Clement J. Medical AI-Warfarin Dosing. 2023.
- [6] Yang CS, Boswell R, Bungard TJ. A case series of the rifampin-warfarin drug interaction: focus on practical warfarin management. *European Journal of Clinical Pharmacology*. 2021;77:341-8.