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LITERATURE REVIEW
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Clinical decision support system for lipid metabolism disorders: relevance and potential

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Current guidelines for the management of patients with dyslipidemia are well known and easily accessible. Despite this, according to research data based on actual clinical practice, selection of optimal tactics for managing patients with dyslipidemia often causes difficulties and leads to a failure to achieve the target levels. Tools such as clinical decision support system (CDSS) can help clinicians follow current clinical guidelines, taking into account the diversity of phenotypic profiles and side effects. This review highlights the effectiveness of CDSS implementation in medical practice as a means for making decisions in managing patients with dyslipidemia, as well as presents the algorithm for CDSS for lipid metabolism disorders created by specialists of the Almazov National Medical Research Center and the University of Milan.

Keywords: cardiovascular risk, prevention, dyslipidemia, statins, digital technologies, decision support systems.

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Failure to reach target low-density lipoprotein cholesterol levels is a stumbling block in cardiovascular prevention

At the heart of cardiovascular prevention is the control of modifiable cardiovascular risk factors (CVR) and the determination of an individual approach in patient management. Today, modification of risk factors (RFs) is actively used in the group of people with high and very high CVR. However, at the population level, the majority of cardiovascular deaths occur in groups with low and moderate CVR, because they are much more numerous (Rose's paradox). Dyslipidemia is one of the key modifiable cardiovascular RFs. It is known that a decrease in low-density lipoprotein (LDL) level for every 1 mmol/L leads to a decrease in risk of all-cause mortality by 10%, cardiovascular mortality — by 20%, stroke — by 17%, and coronary events — by 23% [1]. The concept of control and ways to achieve the target LDL level for each category of patients are reflected in the National and European guidelines on dyslipidemia [2, 3]. However, actual clinical practice demonstrates a number of difficulties on the way to controlling RF and achieving the target LDL level. The DA VINCI study showed that in the primary prevention group, only a small number of patients reach the target LDL values according to 2019 [3] and 2016 [4] European guidelines (33% vs 54%). In the group of patients with registered atherosclerotic cardiovascular diseases (CVDs), only 39% and 18% reach the target LDL level according to 2016 and 2019 guidelines, respectively [5]. Based on this, there is an obvious need to implement effective tools aimed at monitoring and providing a personalized approach in managing patients with CVDs, including at the primary health care level and in all CVR categories.

Implementation of digital technologies in actual clinical practice

The widespread introduction of digital technologies in medicine demonstrates successful results in the diagnosis and treatment of a number of diseases [6, 7]. Decision support system (DSS), introduced into healthcare practice, can be considered as a means for making decisions in patient management [8]. DSS is one of the most promising and rapidly developing areas of modern information technologies. The information programmed in them, which integrates the results of major global randomized clinical trials and current clinical guidelines, can serve as a tool for generating evidence-based decisions when using patient-centered approaches.

One of the first works on DSS introduction into clinical practice, published at the end of 20th century, was a prospective controlled study to assess the use and effectiveness of DSS in hypercholesterolemia treatment. The study was carried out in 25 Birmingham clinics, and the Primed DSS was installed on a desktop computer for each physician. This study evaluated the use of a decision support module for hypercholesterolemia in general clinical practice. The software included a screen for entry of socio-demographic data and CVR factors. In the future, the clinician was asked to enter information from the life history, medical history and cholesterol level. The CVR score was displayed on the screen during data collection. A score higher than 10 was assigned to patients at high risk of CVD over the next five years. After complete data entry, the program offered guidelines on patient management tactics. The system provided detailed information about the recommended dose of the drug, nutrition and physical activity. However, the study has clearly demonstrated that the possibility of widespread introduction of such programs into routine clinical practice depends on the simplicity and convenience of the system. Later, a systematic review [9] evaluating the impact of DSS on physician work and patient outcomes was carried out, which revealed an increase in doctor efficiency in 62 of 97 studies (64%) when DSS was used. Outcomes were assessed in 52 studies, of which 7 studies (13%) reported improved patient outcomes and prognosis. It was noted that studies that asked users to automatically use the system indicated better performance than studies that required users to activate the system themselves. However, the data obtained were based on a comparison of studies carried out in different conditions, with the participation of heterogeneous populations and using different methods.

Interesting data were obtained in a cluster randomized trial conducted in the Netherlands [10]. The study evaluated the effectiveness of electronic alerts versus on-demand DSS in the treatment of patients with dyslipidemia for 12 months. Thirty-eight clinics, 77 doctors and 87886 patients (39433 men aged 18 to 70 years and 48453 women aged 18 to 75 years) took part in the study using the ELIAS electronic health record system. Each clinic was set to automatically receive notifications. There was a function "on demand" or "no notifications". In the alert group, 65% of patients eligible for screening completed it (relative risk (RR) versus controls =1,76; 95% confidence interval (CI), 1,1-2,20) versus 35% of patients in the on-demand group (RR versus control =1,28; 95% CI, 0,98-1,68) and 25% of patients in the control group. In the automatic group, 66% of patients requiring treatment received appropriate therapy (RR versus control =1,40; 95% CI, 1,15-1,70) versus 40% of patients (RR versus control =1,19; 95% CI, 0,94-1,50) in the on-demand group and 36% in the control group. The automatic receipt of DSS alerts has significantly improved

the effectiveness of screening and treatment of dyslipidemia by general practitioners.

In 2010, a pilot study was conducted in Spain [11], the aim of which was to assess the efficacy, safety and cost-effectiveness of HTE-DLP DSS implementation in the treatment of dyslipidemia in high-CVR patients. The follow-up period lasted 2 weeks. Ten medical experts in the field of CVR management were recruited to the study. A total of 77 patients (43 and 34 with very high and high CVR, respectively) with LDL cholesterol >2,5 mmol/L were included in the study. The exclusion criteria were Charlson index >3, patient life expectancy <1 year, and triglyceride levels >4,5 mmol/L. The primary endpoint was an LDL-C level <1,8 mmol/L. HTE-DLP DSS was written in Java using open-source tools (OpenJDK, Netbeans, iText, POI). HTE-DLP provided consistency in clinical decision making, which included the choice of lipid-lowering therapy depending on the patient model and contraindications to therapy. Most of the patients reached an LDL level <1,8 mmol/L (55,0% vs 12,5%, p=0,003; RR: 3,26; CI, 1,16-9,15). High-dose statins and combined lipid-lowering therapy were used more often in the DSS group than in the control group (p=0,001). There were 7 reported adverse effects in the intervention group and 2 in the control group. According to the medical experts, HTE-DL system (86,1%) was useful and was considered easy to use (85%). The use of DSS in high-CVR patients has resulted in significant reductions in LDL-C levels.

It is necessary to note the study [12], the purpose of which was to study the DSS effect on the implementation of measures for secondary prevention in patients with coronary artery disease. The hospitals participating in the study were randomly assigned to 2 groups: intervention (n=56) and conservative care (n=56). The total sample consisted of 7448 patients. The program carried out automatic computer monitoring and provided treatment recommendations. Reminders were sent to primary care physicians in the intervention group every 4 months, updating current patient lipid profiles and recommendations for further treatment. In patients with baseline LDL >3,1 mmol/L, a significant decrease in LDL levels was observed in both groups, but was more pronounced in the intervention one: 3,15±0,88 mmol/L vs 3,21±0,89 mmol/L (P<0,02). A significantly lower rate of readmission due to CVD was recorded in patients who received adequate treatment with lipid-lowering drugs (37% vs 40,9% (p<0,001)). This study has demonstrated that an automated computerized reminder system greatly facilitates adherence and enables clinicians to determine which lipid-lowering therapy option is appropriate for each clinical case.

Chen C, et al. (2010) [13] also demonstrated a positive effect of DSS in the management of dyslipidemia patients. This system allowed the majority of patients to reach the target LDL level in 1 year. In addition, 74% of patients who used DSS consistently achieved target LDL levels. Of those who stopped using DSS, only 57% achieved the LDL goal (odds ratio, 2,1 (1,2, 3,8) (p=0,022)), which indicates the DSS effectiveness in achieving the target LDL level.

When developing a DSS, it is necessary to take into account a large number of factors. In the Netherlands, a study was conducted, which reflected the main characteristics of DSS work in the control and treatment of dyslipidemia according to general practitioners [14]. The CholGate study involved 40 outpatient clinics and 76 general practitioners. A structured questionnaire was sent to each doctor participating in the project. The questionnaire consisted of two parts, the first of which was about user requirements for DSS, while the second one was devoted to checking the knowledge of general practitioners about Netherland's guidelines for dyslipidemia management. The response rate was 71%. As a result, 38% of respondents stated the need to implement DSS in clinical practice. According to the first questionnaire part, the main DSS requirements were as follows: fast speed, convenience and simplicity, beautiful interface, automatic updates via the Internet. As for the second questionnaire part, only 58,8% (standard deviation 13,9) gave correct answers regarding the managing patients with dyslipidemia. Thus, this study demonstrated the main conditions that must be taken into account in the development and implementation of DSS, as well as low compliance to current guidelines in the treatment of patients with dyslipidemia.

Conclusion

Thus, it is obvious that the introduction of DSS system into routine practice has a clinical rationale [15] and can be considered as an effective tool for managing RF, treating CVDs, and predicting cardiovascular events. As part of the preparation of a platform for creating a DSS for lipid metabolism disorders, specialists of the Almazov National Medical Research Center, together with scientists from the University of Milan, created an algorithm for making decisions for dyslipidemia in patients with different CVR levels (available at: https://app.diagrams.net/#G16692nhD8cE6Fu4lXNNtEFdVGK_rsC_XZ).

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