

Prediction algorithm of the functional state of women with postmastectomy syndrome

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Purpose: to create an algorithm for prediction of functional status of women with postmastectomy syndrome in terms of the cardiovascular system.

Material & Methods: theoretical analysis of scientific and methodical literature, chest rheography, tonometry, methods of mathematical statistics. The study involved 165 women with postmastectomy syndrome who underwent radical mastectomy for Madden.

Results: It was developed a method for calculating the forecast level of the integral function of the cardiovascular system of women with postmastectomy syndrome, which took into account the value of an objective definition parameters of central hemodynamic, taking into account their weight coefficients in the structure of the integral index.

Conclusions: the proposed method allows a high degree of reliability to assess the level and conduct a quick monitoring of the functional state of the cardiovascular system of women with postmastectomy syndrome, as well as determine the effectiveness of treatment, rehabilitation, and make adjustments in the rehabilitation program.

Keywords: algorithm, postmastectomy syndrome, women, cardiovascular system.

Introduction

According to many scientists, breast cancer and the associated postmastectomy syndrome, prolonged duration negatively to his notes on the functional state of the cardiovascular system [1; 2; 6–9], which attracts attention to itself by the rehabilitation. Evaluation of functional state has a crucial role in determining the capacity of women with postmastectomy syndrome to carry the load of different nature and can serve as a criterion for the efficiency of physical rehabilitation and the possibility of corrective training program.

Despite the considerable amount of research devoted to the study of functional status of persons of different age groups [3–5], remains unexplored issues for its women with postmastectomy syndrome. In addition, it is important to take into account the integral index of the cardiovascular system, which fully characterize the level of its functional state.

The foregoing definitely indicates the importance of development a method of evaluating the functional state of the cardiovascular system of women with the postmastectomy syndrome to monitor the effectiveness and appropriateness of the applied rehabilitation.

Relationship with the academic programs, plans, themes

The selected research direction corresponds to the research topic of Lviv State University of Physical Culture "Basis of physical rehabilitation of women with the postmastectomy syndrome" (state registration 0115U007008).

The purpose of the research:

to create an algorithm for prediction of functional status of women with postmastectomy syndrome in terms of the cardiovascular system.

Tasks:

1. To prove the criteria of the functional state of women with postmastectomy syndrome.
2. To develop a method of evaluation of the functional state of the cardiovascular system in women with postmastectomy syndrome on the basis of objective consideration of its performance.
3. To determine levels of projected functional state of the cardiovascular system in points.

Material and Methods of the research

The article used the following methods: theoretical analysis of scientific and methodical literature, chest rheography, tonometry, methods of mathematical statistics.

The study was conducted on the basis of Zaporizhzhya Regional Oncology Center. The study involved 165 women with postmastectomy syndrome, who underwent a radical mastectomy for Madden, the average age was 60,27±0,79 years.

Results of the research and their discussion

Algorithm of the development of the model equations to evaluate and verify the validity of the predicted functional status of women with postmastectomy syndrome was conducted in several stages. At the first stage was calculated physical con-

dition level (PCL) by the E. A. Pirogova, 1986 formula [5] and by building correlation matrix were selected multiple regression factors that correlated with the dependent variable (PCL) and explained its variation.

In the multiple regression model to assess the predictable level of the functional state (PLFS) were included those factors that were statistically significant correlation coefficients.

In particular, the following results were obtained calculating the parameters of the linear regression equation:

1. The coefficient of multiple correlation (R) – 0,9705;
2. The coefficient of determination (R²) – 0,9420;
3. The adjusted coefficient of determination – 0.9406;
4. Estimated value of Fisher criterion (F) – 650,34, p<0,0000;
5. The standard error of the equation – 0.03;
6. Free member regression – 1,778981, p<0,0000;
7. Regression coefficients and their level of significance: age – –0,006520, p<0,0000; heart rate (HR) – –0,012944, p<0,0000; cardiac minute output (CMO) – 0,099369, p<0,0000; left ventricular stroke work (LVSW) – –0,076928, p<0,0000.

Normal distribution model residual for visual and statistical analysis indicated the adequacy of the model predictable functional state.

The resulting high coefficient of determination showed that variation of human functional state at 94.20% variation explained by the factors included in the regression equation and only at 5.80% variation explained by factors that were not included in the regression equation, in addition to the high significance of the estimated regression equation suggested Fisher's criterion – 650,34, p<0,0000.

The standard error was 0.03 and helped to determine the confidence interval for the estimated amount of functional state with a probability of 97%.

Thus it could be argued that obtained statistically significant regression equation (the hypothesis that the quantification of the connection between the dependent variable in the model and that it is essential to explain).

In this way, the calculated model of the predictable level of functional state is:

$$PLFS = 1,778 - 0,006 \cdot (50 + 10 \cdot (A - 58,97) / 5,47) - 0,012 \cdot (50 + 10 \cdot (HR - 73,38) / 8,98) + 0,099 \cdot (50 + 10 \cdot (CMO - 3,35) / 0,63) - 0,076 \cdot (50 + 10 \cdot (LVSW - 4,09) / 0,79);$$

where PLFS – predictable functional state of the cardiovascular system;

A – age, years;

HR – heart rate, beats/min;

CMO – cardiac minute output, l/min;

LVSW – left ventricular stroke work, Kgm;

1.778 – free member regression; 0,006; 0,012; 0,099; 0,076 – multiple regression coefficients;

58.97; 5.47; 73.38; 8,98; 3.35; 0.63; 4.09; 0.79 – constants.

Thus, in the multiple regression model to evaluate the predictable level of the functional state of the cardiovascular system included objectively defined parameters of central hemodynamics, which had statistically significant correlation coefficients and their valuation in scores was by standard T-Scale. Based on the calculated PLFS conclude its qualitative and quantitative level (table).

The predictable level of the functional state of the cardiovascular system of women with the postmastectomy syndrome

No c/n	Level of the functional state of the cardiovascular system	Value of the Level
1	Low	<1,63
2	Below average	1,64–1,86
3	Average	1,87–2,09
4	Above average	2,10–2,32
5	High	>2,33

To test the validity of the formula for calculating the estimated amount of the functional state of the cardiovascular system used results Ruf'e index, by determining the correlation coefficient between the actual value and its estimate calculated using regression equation.

As a result of checking the validity of the developed formula was obtained correlation coefficient r=–0,900, p<0,000, indicating that with increasing values predictable functional state decreased index Ruf'e or vice versa.

Conclusions

The proposed method allows a high degree of probability to assess the level and conduct rapid monitoring for the functional state of the cardiovascular system of women with postmastectomy syndrome and to determine the effectiveness of treatment, rehabilitation and make adjustments to the program of rehabilitation.

Prospects for further research include identifying features of the functional state of respiratory system of women with postmastectomy syndrome with different levels of the functional state of the cardiovascular system.

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References

1. Briskin, Yu. A. & Odynets, T. Ie. (2016), "The role of early rehabilitation intervention in restoring the functional state of the cardiovascular system of women with the postmastectomy syndrome", *Teoriia ta metodyka fizychnoho vykhovannia*, No 1, pp. 49–52. (in Ukr.)
2. Briskin, Yu. A. & Odynets, T. Ie. (2015), "Functional status of women cardiorespiratory system with postmastectomy syndrome with different types of attitude to the disease", *Slobozhans'kij naukovy-sportyvnyj visnik*, No (48), pp. 31-34. (in Ukr.)
3. Malikov, M. V., Bohdanovska, N. V. & Svatiev A. V. (2006), *Funktsionalna diahnozyka u fizychnomu vykhovanni i sporti* [Functional diagnosis in physical education and sport], Zaporizhzhia: ZNU. (in Ukr.)
4. Bohdanovska, N. V., & Malikov, M. V. (2012), Pat. 81213. *Sposib vyznachennia rivnia funktsionalnoho stanu sertsevo-sudynnoi systemy orhanizmu* [The method of determining the level of the functional state of the cardio-vascular system], No. U 2012 14779; zaiov. 24.12.2012; opubl. 25.06.2013, Biul. No 12. (in Ukr.)
5. Pirogova, E. A., Ivashchenko, L. YA. & Strapko, N. P. (1986), *Vliianie fizicheskikh uprazhnenij na rabotosposobnost' i zdorov'e cheloveka* [Effect of exercise on performance and health], Zdorov'e, 1986, 152 s. (in Russ.)
6. Strazhev, S. V., Frolkov, V. K. & Bratik, A. V. (2012), "Physical factors in the medical rehabilitation of patients with the syndrome postmastectomy", *Vestnik vosstanovitel'noj medicyny*, No 1, pp. 20-23. (in Russ.)
7. Al-Kindi, S. G. & Oliveira, G. H. (2015), *Prevalence of Preexisting Cardiovascular Disease in Patients With Different Types of Cancer: The Unmet Need for Onco-Cardiology*. Mayo Clin Proc, Vol. 91(1), pp. 81-83.
8. Briskin, Y., Odynets, T. & Pityn, M. (2016), "Influence of the problem-oriented program of physical rehabilitation on the type of attitude to the disease in women with postmastectomy syndrome", *Journal of Physical Education and Sport*, Vol. 16(1), pp. 33–37.
9. Casla, S., Lypez-Tarruella, S., & Jerez, Y. (2015), "Supervised physical exercise improves VO_{2max} , quality of life, and health in early stage breast cancer patients: a randomized controlled trial", *Breast Cancer Res Treat*, Vol. 153(2). pp. 371-382.

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