

PECULIARITIES OF METABOLISM IN PATIENTS WITH A HIGH RISK OF COMPLICATIONS IN THE POSTOPERATIVE PERIOD

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ABSTRACT — In order to develop a methodology for assessing the risk of postoperative complications in surgical patients, the biochemical parameters of 254 patients were studied in the laboratory of the Tver State Medical University scientific center. The patients were aged 16 to 35 years and underwent planned surgical treatment in hospitals of Tver and Moscow. Investigations were performed before surgery, on the first day after surgery and on the fifth day after surgery. It was revealed that if the ratio of the level of matrix metalloproteinase I to the level of magnesium of erythrocytes on the fifth day after surgery is 20% or more higher than the same indicator before surgery, then this patient is more likely to develop complications in the postoperative period. Based on the study results, a patent for an invention (RU) was obtained.

KEYWORDS — postoperative complications, matrix metalloproteinase I, erythrocyte magnesium

INTRODUCTION

The development of postoperative complications remains one of the main problems of surgery [2]. Despite the improvement of surgical methods, the creation of new equipment and new materials, the frequency of complications after surgery is up to 18% [2, 3]. Most complications significantly reduce the quality of life of patients [5]. In our previous studies, it was found that complications more often occur in patients with signs of MASS (Mitral valve, Aorta, Skeleton, Skin) syndrome (MIM 604308) [6]. External signs of MASS syndrome (MIM 604308) are too diverse and do not allow an unambiguous conclusion about the diagnosis. In the surgeon's daily work, conducting a genetic study of the patient may be too costly.

The aim of the study is to develop a methodology for assessing the risk of postoperative complications in surgical patients based on an analysis of changes in biochemical parameters of blood serum.

MATERIALS AND METHODS

We examined 254 patients who were undergoing planned surgical treatment in hospitals in Tver and Moscow. Pairwise comparison method was used. The main group included 177 men and women, aged 16 to 35 years, who had complications after planned operations. They were operated on for inguinal hernia, cholecystitis, vascular pathology of the extremities and pathology of the retroperitoneal space. A long pain syndrome, complications from the surgical wound, a prolonged temperature reaction and patient complaints about a prolonged deterioration in well-being were taken into account as complications. Each patient from the main group corresponded to surgical patients from the control group of the same age, gender and having a similar diagnosis. Biochemical blood testing was done in the laboratory of the scientific center of Tver State Medical University (License No. FS-69-01-000780 dated 23/04/2015). Investigations were performed before surgery, on the first day after surgery and on the fifth day after surgery. The level of alkaline phosphatase, sialic acids, fibrinogen, erythrocyte magnesium, type I C-terminal telopeptide (Cross Laps), matrix metalloproteinase I, matrix metalloproteinase IX in blood serum were determined. The data was processed with the STATISTICA (Stat Soft Russia) and BIOSTAT application software.

RESULTS

Before the operation, biochemical parameters in both groups were in a minor way different. In patients of the main group, the median levels of alkaline phosphatase, sialic acids, fibrinogen, and erythrocyte magnesium were slightly higher than in the control group.

A day after the operation, a gradual change in a number of indicators was revealed. On the fifth day after the operation, changes in the median serum levels of alkaline phosphatase, sialic acids, fibrinogen, erythrocyte magnesium, type I C-terminal telopeptide (Cross Laps), matrix metalloproteinase I, matrix metalloproteinase IX in the main and control groups were significant and reliable.

The most pronounced changes were identified in relation to the level of matrix metalloproteinase I and the level of matrix metalloproteinase IX. The

median level of matrix metalloproteinase I decreased to 9.97 ± 4.21 ng/ml, while in the control group it was 21.04 ± 4.09 ng/ml ($p < 0.01$). The median value of the level of matrix metalloproteinase IX decreased to 412.41 ± 51.07 ng/ml, while in the control group it was 558.11 ± 87.54 ng/ml ($p < 0.01$). It should be noted that the level of erythrocyte magnesium increased to 8.39 ± 0.98 (mmol/L), while in patients without postoperative complications it remained at the level of 5.78 ± 0.79 mmol/L.

CONCLUSION

A mathematical analysis of the data revealed the following pattern: if the ratio of the level of matrix metalloproteinase I to the level of erythrocyte magnesium on the fifth day after surgery is 20% or more higher than the same level before surgery, then this patient is more likely to develop complications in the postoperative period. A systematic analysis of the obtained data suggests that an analysis of the dynamics of the level of matrix metalloproteinase I, the level of matrix metalloproteinase IX and the level of erythrocyte magnesium before surgery and 5 days after surgery can serve as a reliable criterion for the risk of postoperative complications during planned surgical interventions. Based on the results of the study, there was obtained the patent "Method for assessing the risk of developing complications in the distant postoperative period in patients with signs of connective tissue dysplasia" [4].

REFERENCES

1. Classification of complications of the remote postoperative period / Zhukov S.V., Rybakova M.V., Arinchev R.S., Korolenko M.K., Petrova A.V., Shishkin N.V., Shalatonov N.N. DOI: 10.13140/RG.2.2.24416.94727
2. Connective tissue dysplasia as a risk factor complicated course of surgical diseases knee in children / Murga V.V., Krest'yashin V.M., Rasskazov L.V., Rummyantseva G.N., Kartashev V.N., Ivanov YU.N., Zhukov S.V. // Medical news of the North Caucasus. 2016. Vol. 11. N 2–2. P. 338–340. DOI:10.14300/mnnc.2016.11071
3. Method for the prevention of long-term postoperative complications in patients with connective tissue dysplasia / Murga V.V., Rummyantseva G.N., Krest'yashin V.M., Rasskazov L.V., Vinogradov A.F., Ivanov Yu.N., Marasanov N.S., Koptseva A.V., Zhukov S.V., Arinchev R.S. // Patent for invention RUS 2637401 dated 08/03/2016
4. Method for assessing the risk of development of complications in the remote postoperative period in patients who have signs of connective tissue dysplasia / Chirkov R.N., Arinchev R.S., Murga V.V., Zhukov S.V., Rybakova M.V., SamoiloVA N.Yu. // Patent for invention RUS 2664455 dated 03/06/2018
5. Surgical correction of funnel chest deformity in children with use of implants from nitinol / Slizovskiy G.V., Krest'yashin V.M., Sirko L.A., Gunter V.E., Kuzhelivskiy I.I., Shikunova Ya.V., Krest'yashin I.V., Kozyrev A.A., Kim L.V. // *Archiv EuroMedica*. 2017. T. 7. № 2. C. 102–104.
6. The use of physical therapy for knee injuries in children / Khan M.A., Krest'yashin V.M., Vakhova E.L., Krest'yashin I.V., Zimina O.Yu. // *Archiv EuroMedica*. 2019. T. 9. № 1. C. 116. <https://doi.org/10.35630/2199-885X/2019/9/1/116>
7. **SATAVA R. M.** Identification and reduction of surgical error using simulation [Text] // *Min. Invas. Therapy Allied Technol.* – 2005. – Vol. 14 – N 4–5. – P. 257–261.
8. **MADDOX B.K., KEENE D.R., SAKAI L.Y.** The fate of cartilage oligomeric matrix protein is determined by the cell type in the case of a novel mutation in pseudoachondroplasia [Text] // *J. Biol. Chem* – 2007. – Vol. 5 – N 272. – P. 30993–30997.
9. **GENG H., NANDAKUMAR K.S., PRAMHED A.** Cartilage oligomeric matrix protein specific antibodies are pathogenic [Text] // *Arthritis Res. Ther.* – 2012. – Vol. 20 – N 4 – P. 191.