

**INDIVIDUALIZATION OF REHABILITATION TREATMENT AFTER
TOTAL HIP ARTHROPLASTY BASED ON A COMPREHENSIVE
ANALYSIS OF PREDICTORS**

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Abstract: Although total hip arthroplasty (THA) is the "gold standard" of surgical treatment, the effectiveness of postoperative rehabilitation varies significantly among patients. Existing standard protocols do not take into account individual characteristics of bone metabolism and genetic predisposition. Scientific evidence confirms the importance of biochemical markers (osteocalcin, β -CTX), vitamin D status, and type I collagen gene polymorphism (COL1A1) in predicting outcomes, substantiating the need to develop personalized rehabilitation programs.

The aim of the study: To develop and scientifically substantiate an algorithm for personalized medical rehabilitation for patients who have undergone THA, based on a comprehensive assessment of clinical and functional indicators, biochemical markers of bone remodeling and COL1A1 gene polymorphism.

Design and methods: A prospective study included 115 patients after primary TETS. They were divided into a study group (n=57) that received personalized rehabilitation, and a comparison group (n=58) with a standard program. An individualized approach was based on COL1A1 genotyping (rs1800012) and laboratory monitoring (25(OH)D, osteocalcin, PINP, β -CTX, IL-6, CRP). Efficacy was assessed using the Harris Hip Score (HHS), VAS, TUG tests,

and 6-minute walking scales up to 12 months after surgery.

Key results: The developed rehabilitation model integrating genetic and biochemical predictors has proven its clinical effectiveness. Participants in the study group showed statistically significantly better scores on functional recovery (mean HHS score at 6 months: 88.5 versus 82.1 in control; $p < 0.05$) and lower pain levels. There was also an accelerated achievement of key stages of rehabilitation, such as walking independently without support (an average of 28 days versus 42 in the comparison group). The prognostic value of the selected markers for patient stratification and treatment optimization was established.

Conclusions: A personalized approach to rehabilitation after TETS, based on a comprehensive assessment of bone remodeling predictors, is a highly effective and promising strategy. The implementation of the developed program in clinical practice makes it possible to improve functional outcomes, reduce recovery time and improve the quality of life of patients, laying the foundation for a new standard of predictive rehabilitation in orthopedics.

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