

Abstract

The vitamin D metabolic pathway, including vitamin D-binding protein (VDBP) and the vitamin D receptor (VDR), plays a crucial role in the proper functioning of the musculoskeletal system. The association between vitamin D deficiency and the development of orthopedic disorders suggests a potential increased risk of hip prosthesis loosening in patients with low vitamin D levels. Single nucleotide polymorphisms (SNPs) in the VDBP and VDR genes may influence vitamin D bioavailability and its receptor binding through molecular interactions.

The aim of this study was to determine the association between SNPs in the VDR (TaqI – rs731236, ApaI – rs7975232, BsmI – rs1544410, FokI – rs2228570) and VDBP (rs4588, rs7041) genes and the serum concentrations VDBP, and vitamin D (25(OH)D) in patients after total hip arthroplasty. The study included patients after total hip arthroplasty without prosthesis loosening (CA—control arthroplasty), patients with a loosened hip prosthesis (L—loosening), and a control group (C).

Genotyping of VDR and VDBP polymorphisms was performed using PCR-RFLP and qPCR with TaqMan genotyping assay. Serum concentrations of VDR, VDBP, and the inactive form of 25(OH)D were determined using ELISA immunoassays. Statistical analyses included odds ratio (OR) calculations as well as significance and correlation tests.

Studies have shown that the Tt, tt (TaqI), BB, Bb (BsmI), and FF, Ff (FokI) variants in the VDR gene were more frequently observed in patients with loosening, as was the AtBF haplotype, whereas aTbf haplotype was more prevalent in control group. Possible linkage disequilibrium between polymorphisms in the VDR gene influenced VDR protein levels. GG variant in rs4588 polymorphic site and GT haplotype (rs7041/rs4588) of the VDBP gene were more frequent in the prosthesis loosening group. Decreased vitamin D levels among orthopedic patients suggest a potential role of this vitamin in osteointegration and bone repairing processes following total hip arthroplasty, while higher levels of VDR and VDBP may indicate a possible compensatory mechanism.