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Relationship Between Vitamin D Level and Postoperative Complications in The Practice of a Plastic Surgeon

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ABSTRACT

Today, there is a pandemic of vitamin D deficiency around the world. This article is devoted to a comprehensive study of vitamin D deficiency/insufficiency and its effect on postoperative complications in the practice of a plastic surgeon. Complications in plastic surgery is also a hot topic all over the world. The main objective of the study was to identify the correlation between low levels of 25(OH) D and complications after plastic surgery. The study is based on data from 15 patients (4.2%) out of 357 (100%) who had complications after plastic surgery. Vitamin D deficiency/insufficiency was detected in all patients with complications by chemiluminescence immunoassay for 25(OH) D. The lowest level of 25(OH) D (9.3 ng/ml) was found in a patient with a formed keloid scar, the highest level of 25(OH) D in patients with complications was 21.7 ng/ml, which is also a vitamin D insufficiency. Taking into account the findings of the study, the article provides recommendations on the necessary preoperative studies to prevent the development of postoperative complications in the practice of a plastic surgeon.

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vitamin D deficiency; plastic surgery; postoperative complications; rhinoplasty; temporal lifting; otoplasty; SMAS lifting.

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INTRODUCTION

Today the popularity of plastic surgery is growing steadily all over the world. Improving the quality of life, great opportunities for a modern person give the need not only to be physically healthy, but also outwardly attractive. Therefore, the increase in demand for plastic surgery around the world is natural and it will grow every year.

According to the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) and the American College of Surgeons, from 2012 to 2016, 5.78% of plastic surgery patients had ≥1 postoperative complications. **[1]** The most common complications are postoperative bleeding **[2]** seromas, hematomas **[3]** and postoperative infectious complications. Numerous complications can be prevented with careful preoperative examination, patient counseling, and postoperative supervision. Despite all efforts, complications will occur, and early detection is critical to prevent long-term consequences. **[4]**

According to the latest literature data, one of the most important indicators is the level of 25(OH) vitamin D. **[5]**. It is known that it is involved in the regulation of the cardiovascular **[6], [7]**, skeletal, the regulation of the endocrine **[8]** and immune systems. **[9-10]** The authors argue that activated cells of the immune system express the intracellular vitamin D receptor, which implies a potential role for vitamin D as a localized endogenous modulator of immune function. **[11]**

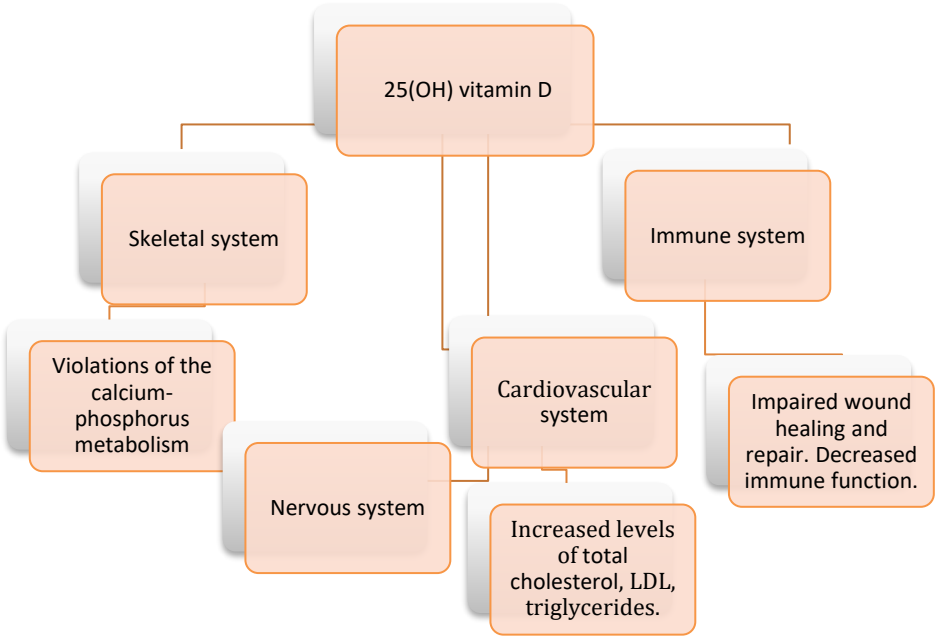

Fig.1: The effect of vitamin D on body systems

Hypovitaminosis D is widespread and is becoming a serious health problem worldwide.**[12]**

For example, in Australia, 31% (22% in men and 39% in women) of adults have 25(OH) D <20 ng/ml and 73% have less than 30 ng/ml. Deficiency was also more common in winter and in people living in South Australia (latitude > 35 °C); 42% of women and 27% of men experienced a deficit during summer-autumn, which increased to 58% and 35%, respectively, during winter-spring. **[13]** .

Contrary to common sense, despite the hot desert climate and the perceived increased access to the sun, the Persian Gulf has one of the highest levels of vitamin D insufficiency in the world **[14].** The prevalence among young people indicates the severity of the insufficiency: up to 70% of Iranian adolescent girls and 80% of Saudi Arabian adolescent girls have vitamin D levels less than 10 ng/ml **[15 - 16]**. A study conducted in the UAE found that 82.5% of the studied patients have a deficiency of vitamin D, 26.4% of women and 18.4% of men were severely 25(OH) D deficient.**[17]** Serum Vitamin D values were also lower in late summer compared to winter, indicating little exposure to outside sun during extremely high summer temperatures**[18].**

The prevalence of vitamin D deficiency and insufficiency in the Brazilian population was up to 45.26%. The highest prevalence of insufficiency was in the southern and southeastern regions, and the highest prevalence of vitamin D deficiency was in the population of the southeastern and northeastern regions **[19].**

In China, and in particular in Beijing, the prevalence of vitamin D deficiency (serum 25(OH) D level ≤20 ng/ml) is 87.1%, with a higher prevalence observed in women (89.0%) than in men (84.9%). Severe vitamin D deficiency (serum 25(OH) D level ≤10 ng/ml) is also higher in women than in men (59.3% and 42.7%, respectively). **[20]**

Studies conducted in 21 African countries showed that the prevalence of low vitamin D levels was 18–46% with serum 25(OH) D levels less than 30 nmol/L; 22–34% for levels less than 50 nmol/L; and 54–59% for levels less than 75 nmol/L. The total average concentration of 25(OH) D was 67–78 nmol/L. **[21]**

In the United States of America, the prevalence of vitamin D deficiency (25(OH) D <50 nmol/L) and vitamin D insufficiency (50≤25(OH) D) in 2001–2010 was 28.9% and 41.4%, respectively. **[22]**

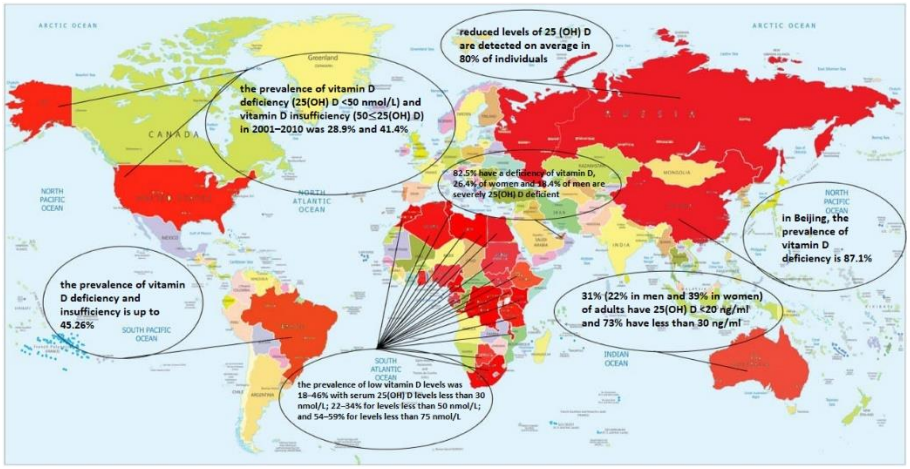

Fig. 2: The prevalence of 25(OH) vitamin D deficiency in the countries of the world

In the Russian Federation, inadequate vitamin D levels in both adults and children have also been proven (reduced levels of 25(OH) D are detected on average in 80% of individuals in the general population). It is known that in St. Petersburg, 82% of people aged 18 to 72 years have an average 25(OH) vitamin D level of 21.9±0.28 ng/ml. In Rostov-on-Don, 82.1% of the population are deficient in vitamin D. In the Chuvash Republic — 94% of people (the average level of vitamin D is 22.6±0.84 ng/ml), in Arkhangelsk — 72% of the population suffer from vitamin D deficiency (the average level in the adult population is 24.3 ng/ml). In the Irkutsk Oblast, there is an insufficiency of 25(OH) D in 82% of women under the age of 70 (the average level of 25(OH) D is 21.22±0.85 ng/ml), and vitamin D deficiency in 100% of women older than 70 years (the average level of 25(OH) D is 15.13±2.2). In the Republic of Bashkortostan, 82% of the adult population over 50 years old has a level of 25(OH) D <20 ng/ml during the period of minimal insolation (the average level of 25(OH) D is 13.42±0.51 ng/ml), and 34% — the level of 25(OH) D <20 ng/ml during the period of maximum insolation (the average level of 25(OH) D is 22.84±0.6 ng/ml). **[23-30]**

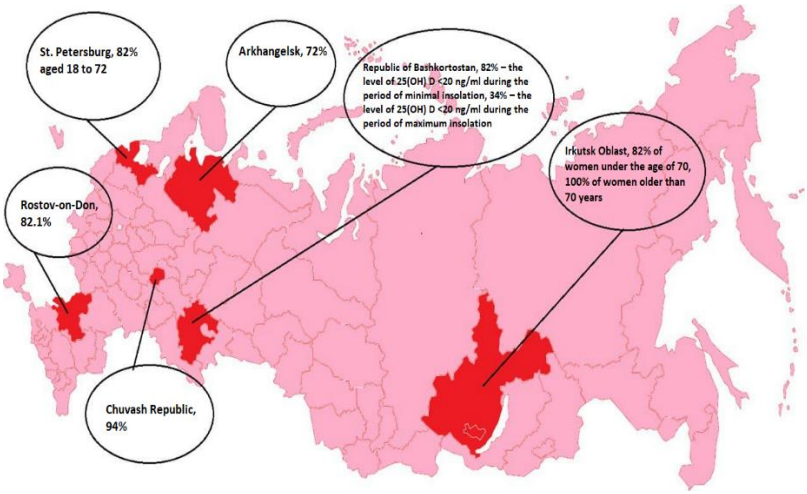

Fig. 3: Prevalence of 25(OH) vitamin D deficiency in the regions of the Russian Federation

According to the clinical guidelines of the Russian Association of Endocrinologists for the diagnosis, treatment and prevention of vitamin D deficiency in adults, vitamin D deficiency is defined as a concentration of 25(OH) D <20 ng/ml (50 nmol/L), insufficiency — a concentration of 25(OH) D from 20 up to 30 ng/ml (from 50 to 75 nmol/L), adequate levels are more than 30 ng/ml (75 nmol/L). The recommended target values of 25 (OH) D for correcting vitamin D deficiency are 30-60 ng/ml (75-150 nmol/L). **[31]**

Insufficient vitamin D levels may contribute to the development of atopic diseases **[32-33]**, and chronic inflammation **[34].**

According to some authors, a deficiency of vitamin D in blood plasma was found in patients with postoperative hypertrophic scars **[35-36]**, and postoperative infectious complications **[37].**

To date, there is a lack of large-scale studies examining complications in plastic surgery**[38].** Having studied the prevalence of 25(OH) vitamin D deficiency around the world and knowing its effect on the body systems, we decided to examine the level of vitamin D in all our patients who had complications after plastic surgery. The cause and frequency of complications in plastic surgery is a hot topic in healthcare around the world, and identifying the correlation between vitamin D levels and complications in the practice of a plastic surgeon will help prevent a significant number of complications in the future.

MATERIALS AND METHODS

In 2019, we performed 357 plastic surgeries. Of these, 224 rhinoplasties (63%), 71 surgeries on the upper and/or lower eyelids (19%), 24 SMAS liftings (7%) and 15 temporal liftings (4%), 15 operations: otoplasties (4%) and others (3%).

All patients who had postoperative complications underwent a blood test for 25(OH) vitamin D by chemiluminescence microparticle immunoassay. The results of the analysis were interpreted as follows: deficiency of 25(OH) D <20 ng/ml (50 nmol/L), insufficiency — concentration of 25(OH) D from 20 to 30 ng/ml (from 50 to 75 nmol/L), adequate levels — more than 30 ng/ml (75 nmol/L). The recommended target values of 25(OH) D for correcting vitamin D deficiency are 30-60 ng/ml (75-150 nmol/L).

RESULTS

Postoperative complications were observed in 15 patients (4.2%) out of 357 (100%). After rhinoplasty, complications were observed in 6 patients (2.7%) out of 224 (100%). Perichondritis was detected in 2 patients (1%), and in 4 patients (1.6%), wound healing occurred by secondary intention.

Table 1. Complication rate in the studied patients

Complication / Surgery	Perichondritis	Ligature fistulas	Suppuration of hematomas	Wounds healing by secondary intention	Keloid scar
Rhinoplasty	2 (1%)	———	———	4 (1,6%)	———
SMAS lifting	———	———	1 (5,1%)	2 (10,2%)	1 (5,1%)
Temporal lifting	———	———	1 (6,6%)	1 (6,6%)	———
Otoplasty	———	3 (20%)	———	———	———

After SMAS lifting, 1 patient (5.1%) had a postoperative complication in the form of hematoma suppuration, and 2 patients (10.2%) had the wound healed by secondary intention, 1 (5.1%) patient developed a keloid scar. In the postoperative period with temporal lobe lifting, complications were observed in 2 patients (13%) out of 15 (100%). After otoplasty, complications were observed in 3 patients (20%) out of 15 (100%) who developed ligature fistulas.

In all 15 patients (100%) who had complications in the postoperative period, the level of vitamin D was at the level of 9.3-21.4 ng/ml. The average level was 12.4 ng/ml.

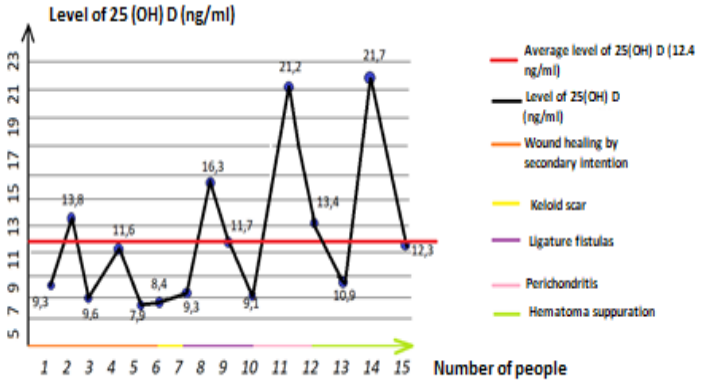

Fig. 4. Level of 25(OH) vitamin D in patients with complications

It should be noted that out of 15 patients (100%) with postoperative complications, the lowest levels of 25(OH) vitamin D were identified in patients with wound healing by secondary intention (6

patients — 40%). Their level of 25(OH) D in the blood averaged 10.1 ng/ml, which is a deficit. In 1 patient (6.7%) with a formed keloid scar, the level of vitamin D was 9.3 ng/ml, which is the lowest level of 25(OH) D of all patients (100%).

In 3 patients (20%) with a postoperative complication in the form of ligature fistula formation, the 25 (OH) D level was 12.4 ng/ml. In patients with complications in the form of perichondritis (13.3%) and hematoma suppuration (20%), the average level of 25(OH) vitamin D in blood plasma was 17.3 ng/ml and 14.9 ng/ml, respectively.

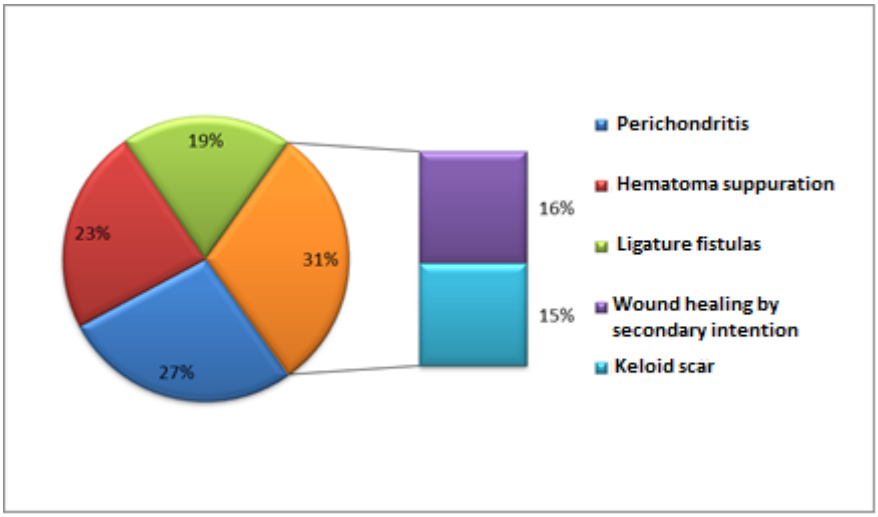

Fig. 5. The structure of the level of 25(OH) vitamin D in complications after plastic surgery

DISCUSSION

Based on the studies, it should be noted that in all patients with complications (100%), the level of 25(OH) vitamin D was below the adequate level.

In 13 patients (86.6%) with complications such as perichondritis, hematoma suppuration, keloid scar, ligature fistulas, wound healing by secondary intention, according to the results of the analysis for 25(OH) D by chemiluminescence immunoassay, a deficiency in the level of vitamin D was revealed (concentration 25(OH) D <20 ng/ml (50 nmol/L)). The lowest level of vitamin D (9.3 ng/ml) was observed in a patient with a developed keloid scar.

In 2 patients (13.4%), with complications such as perichondritis and hematoma suppuration, the analysis revealed a deficiency of 25(OH) D (concentration — 25(OH) D from 20 to 30 ng/ml (from 50 to 75 nmol/L)).

It is noteworthy that in all patients with complications and deficiency/insufficiency of 25(OH) vitamin D, all preoperative laboratory tests were normal. Based on the study, we note that it is necessary to prescribe in advance an analysis for the level of 25(OH) vitamin D to patients planning plastic surgery, and in case of possible deficiency/insufficiency of vitamin D, the operation should be postponed in order to adjust the level of vitamin D to an adequate level (more than 30 ng/ml (75 nmol/L) to prevent postoperative complications).

We conclude that if we had prescribed an analysis for 25(OH) vitamin D in advance for patients planning plastic surgery, followed by a postponement of the operation and adjusting their vitamin D level, perhaps we could have avoided postoperative complications that have arisen.

CONCLUSION

Based on our study, we recommend:

1. To include the analysis of the level of 25(OH) vitamin D in the blood in the clinical minimum of examinations for planned surgical patients.
2. In case of insufficient concentration of 25(OH) D (20-30 mg/ml or 50-75 nmol/L) and deficiency of 25(OH) D (less than 20 mg/ml or 50 nmol/L), to postpone the operation and prescribe the patient is taking cholecalciferol (D3).
3. To include the level of 25(OH) vitamin D below optimal values (30-100 ng/ml) in the relative contraindications to surgical treatment.

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