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## Denying total hip arthroplasty in smokers, patients with alcohol abuse or in patients with human immunodeficiency viruses. Why?

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Nowadays total hip arthroplasty (THA) is one of the most successful surgical procedures in the world and the number of procedures performed is growing every year. However, its success largely depends on the absence of postoperative complications. Among the risk factors affecting the occurrence of postoperative complications are smoking, alcohol abuse, drug abuse, human immunodeficiency viruses (HIV), obesity, anemia, diabetes mellitus, malnutrition, rheumatoid arthritis, cardiovascular diseases, renal failure and dialysis, depression and anxiety. In the presented manuscript, such factors as HIV, smoking and alcohol abuse were considered. In smokers, bone regeneration slows down due to impaired bone metabolism and a slowdown in vascular recovery. Alcohol abuse affects human immunity, inhibiting T-helper cells, and also causing blood coagulation disorders. Alcohol abuse increases the risk of hospital complications, surgery related complications and general medical complications. Smoking can increase the risk of septic complications (lower respiratory tract infection, sepsis, urinary tract infection), myocardial infarction, risk of aseptic loosening of implants. Mortality was also higher in smokers compared to non-smokers. HIV increases bone fragility, debilitation, rate of cardiovascular diseases and decreases the number of CD4<sup>+</sup> cells in the blood, which directly affects the risk of periprosthetic joint infections and revision. All three factors increase the patient's length of stay in the hospital after THA. Currently, recommendations have been developed for preventive measures that need to be taken to reduce the risk of postoperative complications by performing primary THA. According to the recommendations, quitting smoking and drinking alcohol 4 weeks before THA will significantly reduce the risk of postoperative complications. For HIV-positive patients, antiretroviral therapy and subsequent assessing the viral load are required prior to THA. Preoperative care in this category of patients, undergoing primary THA, can reduce the risk of complications. Key words. Human immunodeficiency viruses, alcohol abuse, smoking, total hip arthroplasty, postoperative complication.

Тотальне ендопротезування кульшового суглоба (ТЕКС) є однією з найуспішніших хірургічних процедур у світі, їхня кількість зростає кожен рік. Проте успіх ТЕКС багато в чому залежить від відсутності післяопераційних ускладнень. Серед чинників ризику, які впливають на їхнє виникнення, — куріння, зловживання алкоголем, наркоманія, вірус імунодефіциту людини (ВІЛ), ожиріння, анемія, цукровий діабет, неправильне харчування, ревматоїдний артрит, серцево-судинні захворювання, ниркова недостатність і діаліз, депресія та тривога. Із них у поданій роботі розглянуті ВІЛ, куріння та зловживання алкоголем. Установлено, що в курців регенерація кісток сповільнюється через порушення кісткового метаболізму й уповільнення відновлення судин. Зловживання алкоголем впливає на імунітет людини, пригнічуючи клітини Т-хелпери, також порушується згортання крові. Надмірне вживання алкоголю збільшує ризик госпітальних, загальних медичних і пов'язаних із хірургічним втручанням ускладнень. Куріння може збільшити ризик септичних ускладнень після ТЕКС (інфекція нижніх дихальних шляхів, сепсис, інфекція сечовивідних шляхів), інфаркту міокарда, асептичного розхитування імплантів. Післяопераційна смертність також вища в курців порівняно з некурцями. За ВІЛ збільшується ламкість кісток, частота серцево-судинних захворювань, зменшується кількість клітин CD4<sup>+</sup> у крові, унаслідок чого підвищується ризик перипротезної інфекції та ревізійних втручань. Усі три чинники збільшують тривалість перебування пацієнта в лікарні після ТЕКС. Сьогодні розроблено рекомендації щодо профілактичних заходів для зменшення ризику післяопераційних ускладнень після первинного ТЕКС. Згідно з ними, відмова від куріння та вживання алкоголю за 4 тижні до операції значно знизить ризик післяопераційних ускладнень. ВІЛ-позитивним пацієнтам до ТЕКС слід призначати антиретровірусну терапію та оцінити вірусне навантаження. Передопераційні заходи можуть зменшити ризик ускладнень у разі запланованої операції ТЕКС. Ключові слова. ВІЛ, алкоголізм, куріння, тотальне ендопротезування кульшового суглоба, післяопераційні ускладнення.

**Key words.** Human immunodeficiency viruses, alcohol abuse, smoking, total hip arthroplasty, postoperative complications

Total hip arthroplasty (THA) is one of the most successful surgeries in the world. The number of THA conducted is growing every year, among other reasons this is due to the increase in life expectancy, especially in developed countries. However, there are risk factors for postoperative complications that are associated with both comorbidities and substance abuse. The factors of risk for postoperative complications at primary THA are the following: smoking, alcohol abuse, drug abuse, human immunodeficiency viruses (HIV), obesity, anemia, diabetes mellitus, malnutrition, rheumatoid arthritis, cardiovascular diseases, renal failure and dialysis, depression and anxiety [1]. Large studies involving thousands of patients after THA and TKA have been performed, proving the important role of some of these factors in the occurrence of postoperative complications. T. L. Tan et al. [1] showed that drug abuse and HIV are major risk factors of the occurrence of periprosthetic joint infection among 27,717 patients who underwent TKA or THA, while smoking takes the last place among the listed factors.

*Smoking.* According to the latest data, the majority of smokers in the world are men (942 million) and 75 % of them live in countries with a medium or high human development index [2]. There are almost five times less female smokers (175 million) than male smokers, and 50 % of them live in countries with a very high human development index. The largest number of smokers lives in China (over 220 million) and India (about 100 million) [2]. Smoking causes several disorders in the smoker's body that increase the risk of complications after surgery [3]. In smokers, bone regeneration slows down due to impaired bone metabolism and a slowdown in vascular recovery. Smoking also slows down the immune response of the smoker's body. Another risk factor for infection after surgery may be the presence of tooth decay, due to the generally poor oral hygiene of smokers [3]. There have been several large-scale cohort studies confirming the occurrence of postoperative complications in smoking patients compared with nonsmokers or former smokers [4–8]. J. Matharu et al. [4] in a population-based cohort study of 60,812 THA in UK (12 % smokers, 33 % ex-smokers, 56 % non-smokers) showed that smoking increased the risk of lower respiratory tract infection and myocardial infarction (relative risk (RR) ratio = 0.65; 95 % CI = 0.61–0.69), as well as the use of opioid pain killers in the first year after. The risk of mortality within a year after

THA was also increased (hazard ratio (HR) = 0.37, CI = 0.29–0.49 and HR = 0.53, CI = 0.40–0.70) in smokers compared to nonsmokers and ex-smokers. In a similar 2021 cohort study of 67,897 patients after THA in USA (13,8 % smokers), the authors also confirmed that smokers have a high chance of pulmonary complication (odds ratio (OR) = 1.352; 95 % CI, 1.075–1.700) [5]. In addition, the instances of infectious complications (OR = 1.310; 95 % CI, 1.094–1.567) and extended hospital stay (OR = 1.17; 95 % CI, 1.099–1.251) are increased [5]. The results of cohort study of 63,446 patients after THA in USA (Nationwide Inpatient Sample; 20 % smokers) confirmed the high occurrence of complications in smokers associated with the cardiovascular system, lungs and kidneys [6]. Also, there is an increased chance of infection (sepsis, urinary tract infection). Mortality was also higher in smokers compared to nonsmokers (OR = 11.7; 95 % CI, 2.0–70.5) [6]. As a result of a meta-analysis of 6 cohort studies (8181 patients; 55 % smokers), it was found that smokers after THA have a high risk of aseptic loosening of prosthesis and deep infection [7]. However, no effect on length of hospital stay was found [7]. The results of a prospective cohort study of 7926 patients after THA or TKA in Mayo Clinic (USA) also confirm the high risk of deep infection (HR = 2.37; 95 % CI, 1.19–4.72) and implant revision (HR = 1.78; 95% CI, 1.01–3.13) in smokers [8]. According to the 2018 Consensus meeting on musculoskeletal infection, the risk of periprosthetic infection in smokers is high, but there is limited evidence [9].

*Alcohol* as a risk factor in 2016 led to the death of 2.2 % of women and 7.8 % of men in the world [10]. As in the case of smoking, alcohol dependence is more often observed in men (6 %) than in women (1.6 %) in the world [11]. The largest number of alcohol addicts lives in Latvia ( $\approx$  11 %), Hungary and Russian Federation ( $\approx$  7 %). Among them, men also predominate and their number is 5 times more than women [11]. Despite the prevalence of alcohol dependence in the world, identifying it in a patient can be difficult for medical personnel. In this regard, WHO developed the Alcohol Use Disorders Identification Test (AUDIT) [12]. The AUDIT consists of two pages, one of which is completed by the patient himself, and the other by the medical staff, and allows you to identify any alcohol-related disorders in the patient. Among the effects that may be associated with the influence of alcohol dependence on

the occurrence of postoperative complications is affects human immunity, inhibiting T-helper cells [3], and also causing blood coagulation disorders [13, 14]. These changes can increase the risk of infection and increased mortality in the event of injury [14]. Several large cohort studies have shown a negative role for alcohol in postoperative complications. [15, 16]. The impact of alcohol abuse is analyzed in a cohort study of 8,372,232 patients after THA or TKA in USA (National Hospital Discharge Survey) [15]. It has been found that alcohol abuse affects hospital complications (OR: 1.334, range: 1.307–1.361); surgery related complications (OR: 1.293, range: 1.218–1.373); general medical complications (OR: 1.300, range: 1.273–1.327) of complications, and also increases the length of hospital stay by 9 times [15]. In a register-based cohort study of 30,799 patients after THA or TKA (53 % THA) in Denmark (alcohol consumption before THA or TKA — 0 grams of pure alcohol/week, > 0–168 g/week, > 168–252 g/week, and > 252 g/week), the authors compared the effect of different alcohol consumption on the results of THA or TKA [16]. Risk of prosthetic infection was higher in patients with alcohol consumption of 168–252 g/week (HR 1.55, 95 % CI, 1.13–2.13) compared to those who consumed no alcohol at all. However, risk of cardiovascular disease after 30 days was lower in patients with alcohol consumption of 0–168 g/week (HR 0.68, 95 % CI, 0.50–0.92) compared to those who consumed no alcohol at all. Risk of mortality after both 90 days (HR 0.55, 95 % CI, 0.41–0.74) and 1 year (HR 0.61, 95 % CI, 0.51–0.73) was lower in patients with alcohol consumption of 0–168 g/week compared to those who consumed no alcohol at all [16]. According to the authors, preoperative guidance and intervention for patients with low-to-moderate alcohol consumption can potentially be more lenient when suggesting abstinence, but preoperative abstinence should still be enforced for high and excessive drinkers. However, at the General Assembly for Prevention and Host Related General: Proceedings of International Consensus on Orthopedic Infections in 2018, a vote was taken on the factors that can influence the occurrence of periprosthetic infection, among them smoking and alcohol with a high level of evidence [9].

*Human Immunodeficiency Virus* (HIV) is a retrovirus that affects approximately 35,9 million adult people worldwide in 2020, according to UNAIDS [17]. 53 % of the total number of HIV infected women [17]. Among the many health problems caused by HIV, some of them have a pronounced effect on the outcome of surgery. Among them are

high bone fragility [18], debilitation, cardiovascular disease [19]. The number of CD4+ cells in the blood is especially important, which directly affects the risk of postoperative infection in such patients [19]. There have been several large-scale studies [20, 21] and systematic reviews [22, 23] evaluating postoperative risks in patients with HIV, including the dependence of the availability of antiretroviral therapy. In one of the largest studies based on the analysis of a database of more than 2.5 million HIV patients after THA in USA (2,656,696 — without HIV and 9275 — with HIV) it was found that patients with HIV are more likely to have extended hospital stay (4.31 versus 3.83 days,  $p < 0.001$ ) and the incidence of postoperative complications of different degrees of severity is higher in comparison with patients without HIV [20]. The results of another study, also based on database analysis of 729,101 patients after THA in USA, showed differences in the postoperative period in patients with HIV, depending on the availability of antiretroviral therapy [21]. It was noted that patients on antiretroviral therapy have an increased risk of postoperative infection (5.3 % versus 4.2 %), while the absence of therapy does not affect the length of hospital stay (4.1–4.3 days) compared to patients with antiretroviral therapy. The readmission rate of 30-day is slightly higher in patients on antiretroviral therapy (4.2 % versus 3.5 %) than in patients without therapy [21]. O'Neill et al. in systematic review had proven an increased risk of infection (RR = 3.31; 95 % CI = 1.18; 9.29) and revision (RR = 2.35; 95 % CI = 0.93; 5.95) in HIV-positive patients undergoing THA or TKA in a subgroup analysis [22]. However, these findings are based on poor quality evidence in a limited number of studies ( $n = 4$ ) and need to be interpreted with caution. Further research should concentrate on large, well-designed, prospective studies, that control for co-morbidities and employ standardized outcome measures to allow for direct comparison. Dimitriou D. et al. in a systematic review of 21 studies analyzed for complication and prosthesis survivorship rates, and relative risks in HIV patients after THA or TKA [23]. It was found that HIV-positive patients have a significantly increased risk of periprosthetic joint infections (7.6 % versus 3.3 %) compared to HIV-negative controls in 16 studies. At the same time, survivorship and survivorship rates did not differ significantly between HIV+ and HIV- patients in 11 studies. According to the delegates' decision at the Meeting on Musculoskeletal Infection of 2018, HIV increases the risk of surgical site infection and periprosthetic joint infection, but prescribing antiret-

roviral therapy to HIV patients significantly reduces it [9].

Currently, recommendations have been developed for preventive measures that need to be taken to reduce the risk of postoperative complications in the event of elective THA. According to the Enhanced Recovery After Surgery (ERAS<sup>®</sup>) Society recommendations of 2020, one must abstain from smoking at least 4 weeks before THA [24]. For alcohol cessation, the level of evidence is lower than for smoking cessation. However, there is evidence that positive changes occur in the body starting from the 4<sup>th</sup> week of quitting alcohol consumption, which will help reduce the level of complications after THA [3]. A detailed preoperative planning of the patient with HIV aimed at reducing the risk of postoperative complications has been developed. The main checkpoints include assessing the viral load in the case of undergoing antiretroviral therapy, as well as checking the count of CD4+ < 200 cells/mm<sup>3</sup>. If the values differ from the recommended ones, the operation must be postponed, with the prescription of a due therapy by a specialized physician [19].

Smoking, alcohol abuse and HIV are risk factors for postoperative complications in patients after THA, including periprosthetic infection, aseptic loosening and increased mortality. For these reasons, THA may be denied. However, in the case of elective surgery, patients should be advised to quit smoking and drinking alcohol approximately 4 weeks before the surgery, and patients with HIV should be advised to undergo antiretroviral therapy and monitor its effectiveness. Taking preventive measures will reduce the risk of complications after THA.

**Conflict of interest.** The authors declare the absence of conflict of interest.

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## DENYING TOTAL HIP ARTHROPLASTY IN SMOKERS, PATIENTS WITH ALCOHOL ABUSE OR IN PATIENTS WITH HUMAN IMMUNODEFICIENCY VIRUSES. WHY?

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