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Functional state of patients with an increased body mass index in the early rehabilitation period after total knee joint arthroplasty (preliminary report)

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Purpose To assess the impact of increased body mass index on intraoperative indicators and early postoperative clinical and functional results in total knee arthroplasty **Materials and methods** We studied 74 patients with severe gonarthrosis. The patients were divided into four groups, depending on their body mass index (BMI). The first group consisted of 27 people (comparison group) with normal BMI (18.5–24.9). The second group included 22 persons with a BMI range of 25–34.9. The third group included 16 patients with BMI that ranged 35–39.9, and the fourth group included nine patients with BMI ⩾ 40. **Results** The results of the study confirmed the fact of a slight increase in the duration of the operation and intraoperative blood loss in patients with obesity. However, a three-month period examination after surgery showed comparable efficacy of arthroplasty in reducing pain and functional outcomes achieved in all groups. **Conclusion** Total knee arthroplasty is effective in severe gonarthrosis in all patients, regardless of BMI. Anatomical and functional status of patients improved significantly in the postoperative period in all groups of the patients studied.
Keywords: osteoarthritis, arthroplasty, knee joint, obesity

INTRODUCTION

Obesity has become a problem of not only medical but also of a social significance. The problem does not depend on social background and professional affiliation, area of residence, age and gender of a person. According to WHO, there are over 1.7 billion people in the world who are overweight or obese. In most developed countries of Europe, obesity affects from 15 to 25 % of the adult population [1, 2].

According to studies in Russia, 54 % of men over 20 years of age are overweight and 15 % are obese. Obesity affects 28.5 % of Russian women and almost 59 % of them are overweight [3]. Harmful impacts of overweight on functions of all organs and systems have been known, including the one on the state of the musculoskeletal system and joints. Overweight is a factor contributing to a very rapid degeneration of the cartilage tissue and development of early arthritis of large joints. Overweight and obesity have a detrimental impact on the function of the knee joint [4]. Increased loads associated with an increased body weight are the cause of its degenerative changes and the need for joint arthroplasty [5].

Treatment of patients with obesity is a difficult task for the orthopedic surgeon. The total time of intervention, the role of bariatric surgery, and the issue of whether surgeons should postpone knee replacement in patients with high BMI, is a matter of ongoing debate [6].

Most clinical studies show that patients with BMI ⩾ 28 kg/m and morbid obesity (BMI ⩾ 40 kg/m) have an increased risk of postoperative complications in TJR and a shorter implant stability (only 74 % of implants showed a 5-year survival) after total knee arthroplasty (TKA) [7]. However, some clinicians argue this point of view and claim that there are similar complications and similar periods of prosthesis survival, regardless of BMI [8]. There is currently no unanimous opinion. Though high incidence of some complications (for example, skin infections) in obese patients has not been disputed [9, 10]. At the same time, a guaranteed relief from chronic pain associated with a neuropathic component due to osteoarthritis is the main goal in improving the quality of life of any patient, regardless of BMI.

Our aim was to evaluate the effect of increased body mass index on intraoperative indicators and early postoperative clinical and functional results in TKA.

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MATERIAL AND METHODS

The study was conducted at orthopedic department 2 of the Clinical Hospital of the Ministry of Health of the Republic of Tatarstan, city of Kazan. There were 74 patients with severe gonarthrosis. Each patient underwent clinical and functional assessment before, after the intervention and at three months after knee arthroplasty performed due to gonarthrosis of various etiology associated with severe pain and limited function in the joint. There were four groups of patients according to their BMI; the comparison group was patients with normal BMI. Body mass index (BMI) is a value of correspondence of person's weight and height, which is a relative criterion of insufficient, normal or overweight person's body mass. The index is the ratio of the body weight in kilograms to the square of the height in meters (kg/m^2) [1]. Orthopedic examination was performed according to the standard procedure. Functional evaluation used the VAS scale for pain (cm); and the condition of the knee joints before surgery, on discharge from the hospital, and after three months was assessed using the Knee Society Score and Oxford Knee Score (points). For statistical processing of the obtained data, a two-sample Student's t-test for independent and dependent samples was used.

Seventy-four patients were treated (27 men and 47 women) aged from 58 to 70 years (mean age, 63.6 ± 6.7 years) with a history of stage 3 gonarthrosis. All patients underwent a planned TKA. The average body mass amounted to 81.4 ± 13.4 kg and mean height was 162.2 ± 8.9 cm. The minimum BMI was 20.55, the maximum was 50.0 (mean, 31.2 ± 6.9). The first group consisted of 27 people (comparison group) with a normal BMI (18.5–24.9). The second group included 22 persons with a BMI of 25–34.9. The third group included 16 patients with BMI of 35 39.9, and nine patients of the fourth group had BMI ⩾ 40. Each patient underwent unilateral replacement of the affected knee joint, since each specific intervention was evaluated: 37 cases of the left knee joint were analyzed and 37 of the right one. Two surgeons using one implant type (cemented, total) performed arthroplasty through a medial access to the knee joint. Tourniquet was not applied. Anesthesia was conducted according to the multimodal principle using neuroaxial blockades both during the intervention and in the postoperative period. In each group, such perioperative criteria as duration of the operation, inpatient stay, blood loss, and early complications were evaluated. Antibiotic therapy and thromboprophylaxis were obligatory in the tactics of patients' management. The verticalization and full load on the operated joint were encouraged on the following day after the intervention.

RESULTS AND DISCUSSION

Table 1 presents perioperative indicators in patients of four groups.

Thus, there was no statistically significant difference in the indicators in the groups with elevated BMI. When they were compared with patients with normal BMI, blood loss in groups of patients with elevated BMI was significantly increased ($p = 0.002$). The duration of surgery in patients with increased BMI was statistically increased ($p = 0.01$). We received a statistically insignificant difference when analyzed hospitalization in groups ($p = 0.08$). The complications obtained were as follows. One patient of group 4 had pulmonary embolism in the postoperative period with a favorable outcome; patients of groups 2 and 3 suffered from phlebothrombosis in the early postoperative period. Due to a small sample size and few complications, the search for statistical hypotheses was not possible.

Table 1

Perioperative indicators in patients after TKA with various BMI

Groups	BMI	Duration of intervention, min	Inpatient stay, days	Blood loss, ml	Number of complications
Group 1, n = 27	18.5–24.9	92.7 ± 22.5	10.07 ± 1.56	218.3 ± 26.8	–
Group 2, n = 22	25–34.9	105.3 ± 22.4	10.6 ± 1.94	244.3 ± 41.7	3
Group 3, n = 16	35–39.9				2
Group 4, n = 9	⩾40				1

In general, the time of surgery was significantly increased patients with elevated BMI, which increases the anesthetic and surgical risks in terms of complications. In addition, blood loss was bigger due to the physiological characteristics of coagulation potential of blood in patients with obesity.

The dynamics of the anatomical and functional status of patients according to the quality of life assessment (OKS) scales is presented in **Figure 1**. There was no statistically significant difference between the indicators (we used a comparison between the group with a normal BMI and groups with elevated BMI) of anatomical and functional status of patients after TKA before the operation (p = 0.11), before discharge (p = 0.35), and after 3 months (p = 0.06). However, there was a significant difference in all groups studied (when comparing OKS scores as dependent samples), before discharge and three months after surgery, in all cases p = 2.35 E-09). OKS points ranking: 0–29 (severe knee OA); 30–39 (moderate OA changes); 40–48 (satisfactory condition of the knee joint).

Figure 2 shows the dynamics in the improvement of knee joint functions in patients of the observation groups after TKA.

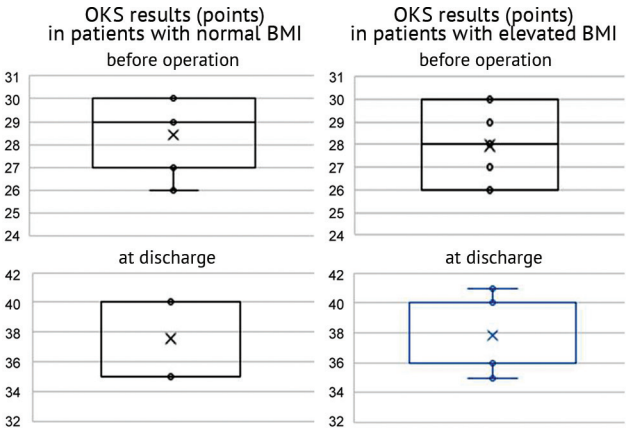

Fig. 1 Diagrams of the dynamics of OKS indicators in different groups of patients, taking into account the exclusive median, average points and lines

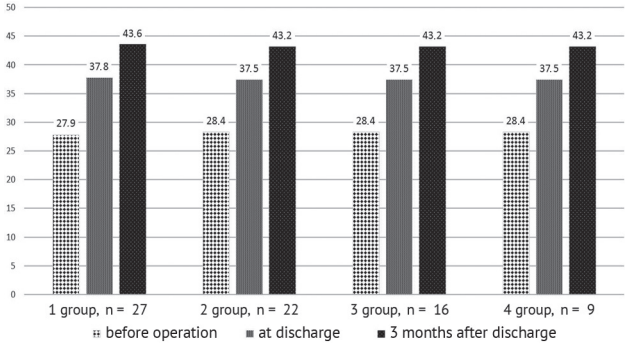

Fig. 2 Indicators of the OKS scale in patients with different BMI after TKA, points

Dynamics according to VAS scale is presented as a diagram (**Fig. 3**).

There were no statistically significant differences between the indicators (we used a comparison in the group with normal BMI and groups with elevated BMI) of the anatomical and functional status of patients after TKA according to VAS scale before surgery (p = 0.23), before discharge (p = 0.4), and after three months (p = 0.76). However, there was a significant difference in all observation groups (when compared as dependent samples in the dynamics according to the VAS scale) before, at discharge and three months after surgery, in all cases p = 1.29E-14. Thus, there was pain relief in patients of all groups as they did not experience neuropathic pain due to OA, and the difference did not depend on the patient's body weight (**Fig. 3**).

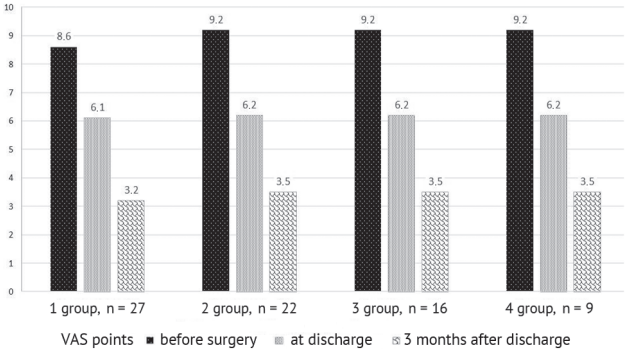

Fig. 3 Dynamics of the patients' functional status according to VAS, cm

Similar results were obtained after statistical processing of the results on the KSS scale. The differences between the indicators (we used comparison in the group with normal BMI and groups with elevated BMI) of the anatomical and functional status of patients after TKA according to this scale was not shown before surgery (p = 0.31), before discharge (p = 0.44), and after three months (p = 0.1). Dynamics is shown in Figure 4.

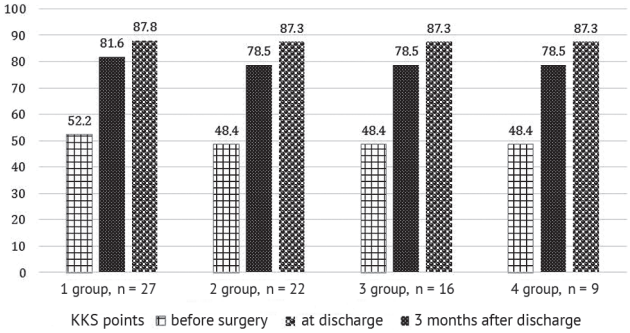

Fig. 4 Dynamics of patients' functional status according to KSS (points)

There is a significant difference in all observation groups (when comparing as dependent samples for dynamics on the KSS scale) before, at discharge and three months after surgery, in all cases p = 1.07 E-09.

Clinical case

Patient B., 69 years old, was admitted for a planned inpatient treatment with a diagnosis of right-side gonarthrosis in stage 3. She complained of pain and restriction of movements in the right knee joint, growing over 7 years. Her body weight increased by three kilos over the past two years due to a sedentary lifestyle. Her weight was 94 kg and her height was 143 cm, with BMI = 46 (morbid obesity) at admission. On examination, she felt a characteristic local pain along the medial surface of the proximal metaepiphyseal zone of the tibia. The range of movements in the right knee joint was flexion/extension 90°/15°/15° (contracture). Varus deformity of the right leg was 9°. Radiographs of the knee joint showed an uneven narrowing of the joint space with a minimum height (1 mm) in the medial zone. Diagnosis of stage 3 gonarthrosis was confirmed. Subchondral sclerosis of the endplate of the femur, tibia, and patella. Rough marginal exostoses of the articular surfaces of adjacent bones were present. Anatomical and functional assessment of the knee condition upon admission was VAS – 9.8 cm, KSS – 45 points, OKS – 26 points. The patient had prior conservative treatment (NSAIDs, chondroprotectors, intra-articular hyaluronic acid injections and physiotherapy). A moderate positive effect from conservative treatment lasted for 3 to 6 months but the treatment was ineffective.

Arthroplasty of the right knee joint ran under spinal anesthesia; Smith & Nethew GENESIS II cemented implant was used.

Functional assessment of the condition of the knee joint at the time of discharge was: VAS – 8 cm, KSS – 66 points, OKS – 28 points.

During the observation period after the surgery, there was a positive dynamics of the anatomical and functional status on the VAS, OKS and KSS scales. At the stage of early rehabilitation (three months after surgery), pain on VAS scale decreased from 8 cm to 2.4 cm. Functional indicators increased in KSS score from 66 points to 86 points, and in OKS from 28 points to 39 points. Flexion and extension improved (130° / 0° / 5°).

There was a general positive dynamics in each of the estimated indices after three months (end of patients' initial phase of rehabilitation) up to "good". The motor function of the joint fully restored.

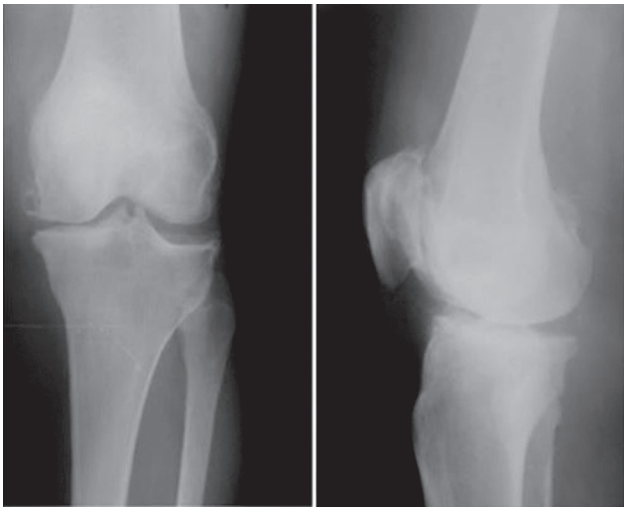

Fig. 5 Radiographs of the right knee joint before arthroplasty

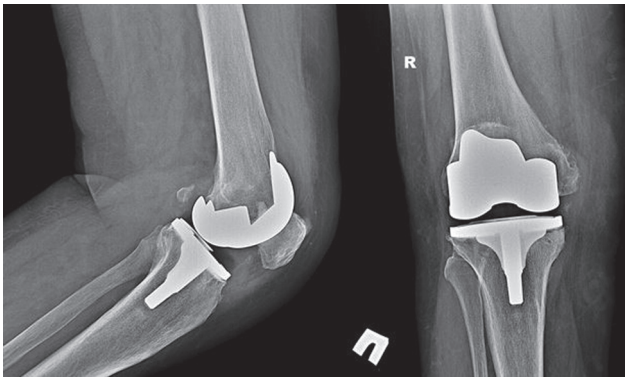

Fig. 6 Radiographs of the right knee joint of the patient three months after surgery

CONCLUSIONS

The study resulted in the following conclusions:

1. TKA is effective in severe gonarthrosis in all patients, regardless of BMI.

2. Anatomical and functional status of patients improved significantly in the postoperative period in all the groups studied.

3. An important point is the absence of a statistically significant difference in improvements between the patients with a normal BMI and with an increased BMI. It is noteworthy that the results were similar in the subgroups ranked by the degree of obesity.

4. Statistically significant was an improved quality of life on various scales in the early rehabilitation period.

In general, it is necessary to point out a good potential of TKA in patients with increased BMI. However, some issues need to be clarified. In particular, the analysis of the structure of typical complications in TKA, as well as the implant survival rate at long-term follow-ups (⩾ 5 years) should be further studied.

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