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Possibilities of Hip Arthroplasty on the Background of Impaired Bone Metabolism

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Abstract: *The results of clinical and X – ray monitoring in patients undergoing hip arthroplasty, in background of subcompensated bone metabolism had been analyzed . Studied the efficacy of zoledronic acid in combination with calcium and active metabolites of vitamin D3. Studied objective parameters of functional activity, the subjective perception of life quality, as well as quantitative parameters of X – ray monitoring. It is noted that short courses of antiresorptive therapy effectively influence the parameters of functional activity and quality of life.*

Keywords*: hip arthroplasty, bone metabolism, antiresorptive therapy, bone mineral density, osteoarthritis of the hip.*

I. Relevance

Currently, there is an increase in the length of life of the citizens of developed countries. In connection with this destructive - dystrophic diseases of the skeleton found widespread and important social significance. There has been an objective phenomenon of increasing requirements for quality of care and the level of social reintegration of patients with diseases of the large joints of the skeleton. In this sense, Arthroplasty has become one of the main methods of treatment of decompensated forms of degenerative diseases and injuries in hip.

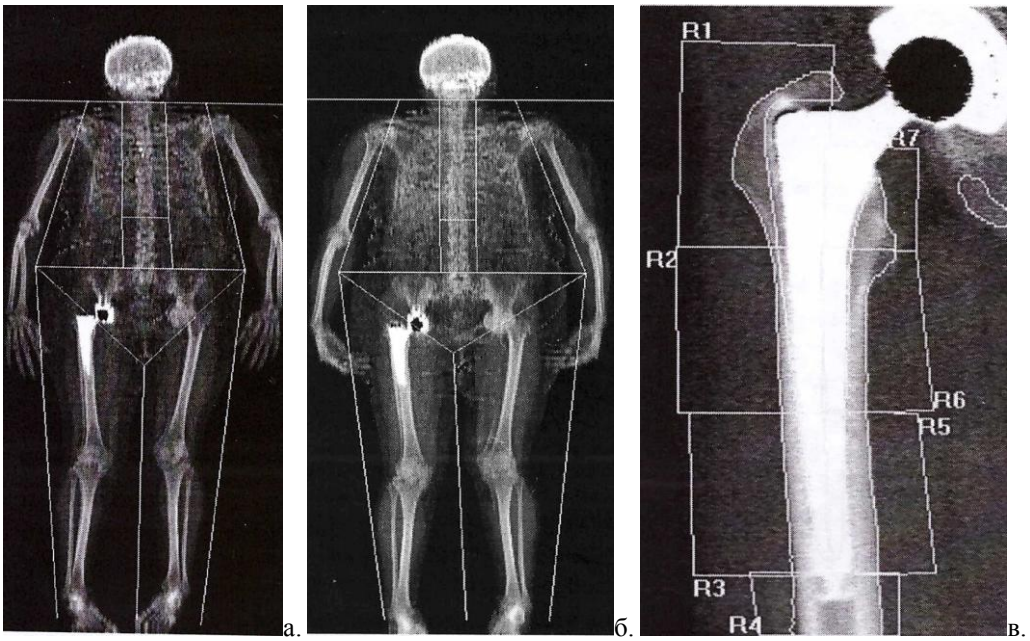
The widespread introduction of Arthroplasty provides effective social and household reintegration of patients. Accumulated huge experience in the world and in domestic practice of evaluating outcomes of the medical technology, interpretation of this phenomenon has led to the analysis of survival of implants, which is due to both local and general reaction of organism on artificial kinematic. It is known that patients having a background of disturbances in bone metabolism , survival of implants is significantly less, such as immuno - inflammatory disease [1]. However, there is a little question on result of Arthroplasty as it depends on the quality of the bone tissue of the operated segment and mineral homeostasis of the patient as a whole. Thereby it is interesting to do systematic assessment of bone metabolism in the postoperative period in patients undergoing hip replacement.

In the Russian literature describes various approaches to postoperative management of patients on the background of subcompensated bone metabolism; since some authors argue for monitoring bone metabolism and the subsequent combination of preventive antiresorptive therapy with calcium supplements, vitamin D3 metabolites, bisphosphonates [1, 2, 9, 7, 6] or strontium ranelate [4], which in their view significantly reduces the risk of aseptic loosening, while other authors consider that the need for such therapy in the early postoperative as the main role in the short and medium term plays primary stability attained in the bone implant intraoperatively [5]. Foreign Literature does not give and analysis An unambiguous answer. This polarity of views reflects the lack of a common understanding of the role of local and general outcome of bone metabolism in the motor rehabilitation, as well as the pathogenesis of aseptic instability in the postoperative period which justifies the need for further study as a premorbid state of bone metabolism and its features in the postoperative period. The aim of this study was the evaluation of the effectiveness of the combined efficiency of antiresorptive therapy on rehabilitation and the physical component of life quality after hip arthroplasty.

II. Material And Methods

We analyzed the results of 72 patients with osteoarthritis of the hip (III - IV stage of Kellgren - Lawrence), underwent total cementless arthroplasty observed in the clinic of Traumatology and Orthopedics (Russia, Ufa) from 2011 to 2014. The average age of patients at enrollment was 63.41 years ± 12,15 SD (59 - 87 years). The prospective study included patients with T – criterion of femoral neck of operated limb in the range of - 1 to - 2,5 SD.

Fig. 1. Evaluation of anthropometric parameters. (different city)



а. б. в.

Fig.2. All body DEXA in dynamics; Gruen Zones DEXA ; g –skeleton Scintigraphy. .

Postoperatively, the patients of the main group (n = 37) was recommended for combined Antiresorptive therapy including 1000 mg calcium, 2000 IU vitamin D3, and intravenous infusion of 5 mg of zoledronic acid (Novartis GmbH). Patients comparison group (n = 35) was recommended by the reception of the combined calcium and vitamin D3 in similar dosages. Groups were formed based on the comparability of age ranges, anthropometry, and the degree of demineralization of operated limb according to absorptiometry. Do not expose the analysis of the results of arthroplasty performed with impaired technology, such as the position of the femoral component in the frontal plane with respect to the mechanical axis of the femur more than 20 degrees, the location of the acetabular component does not coincide with the center of rotation of the hip joint.

Patients , in the early postoperative period ,were recommended partial body weight on the operated limb, with additional support. Parameter estimation of functional activity on scale - Harris Hip Score, questionnaire SF - 36 and ULSA, performed at 3, 6, 12 and 18 months after surgery. Analysis of the data of radiation monitoring techniques using X-ray absorptiometry in the operated limb in the zones Gruen, as well as in the "body" held at 6, 12 and 18 months of observation.

Statistical analysis was carried out with methods of descriptive statistics, estimated mean values of clinical and instrumental diagnostics, standard deviation, standard error, variance of characteristics (by Fisher technique), the differences were considered significant at a significance level of less than 0.05.

III. Results Of The Study

Long-term results of functional activity in terms of 12 to 18 months were analyzed in 32 (86.4%) patients of the main group and 29 (82.8%) of the comparison group. Estimation of parameter of functional activity scale Harris Hip Score, after 1 month post op, did not reveal significant differences in the two groups, but the differences became significant by the end of 3 months of observations, in particular significantly different severity of pain and the possibility of independent movement ($p < 0,05$) . One year after arthroplasty HHS average value in the study group was 82.9 points ± 12,4 SD, which was significantly higher compared to the comparison group, the same parameter whose score was equal 75,6 ± 8,2 SD. ($P < 0,01$), while the significance of differences persisted for up to 18 months of observation (Fig. 3).

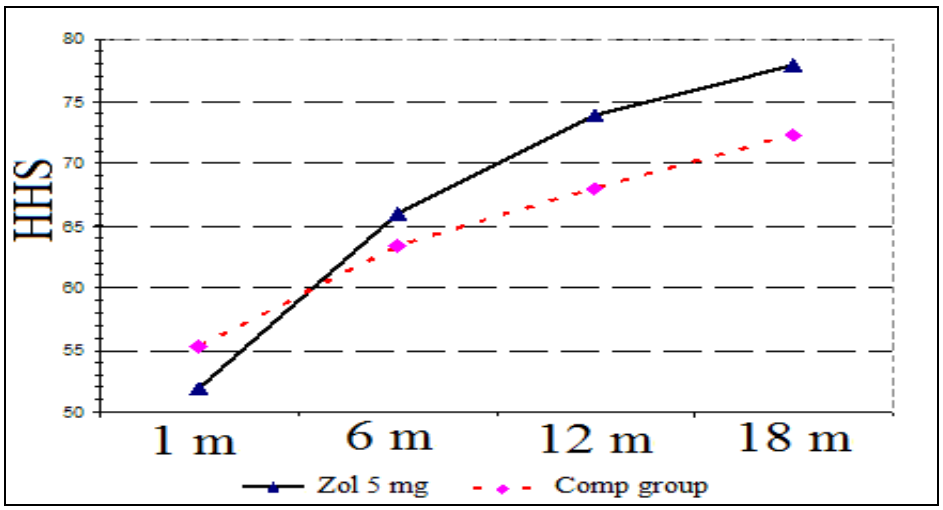


Fig. 3. The median HHS comparable groups in the postoperative period

In general, the restoration of functional activity was more effective in patients of the main group, the amount of good (over 80) and satisfactory (over 70 points) functional results year after arthroplasty which was 26 (81.25%) cases, which was significantly higher than that a group of comparison, comparable results which have been identified in 21 (72.41%) patients.

The parameters of quality of life according to the scales of SF - 36, showed positive value during the rehabilitation period, in patients of both groups. However, significant benefits have been observed in patients of the main group after 3 months of the arthroplasty, especially in the parameters of physical, emotional and social component of quality of life. In Patients of control group, noted a slow recovery of the vital and mental component of quality of life, which was connected with both the function of the operated limb, and subjective general health, and low values of these parameters were observed even after 6 months of arthroplasty (Fig. 4)

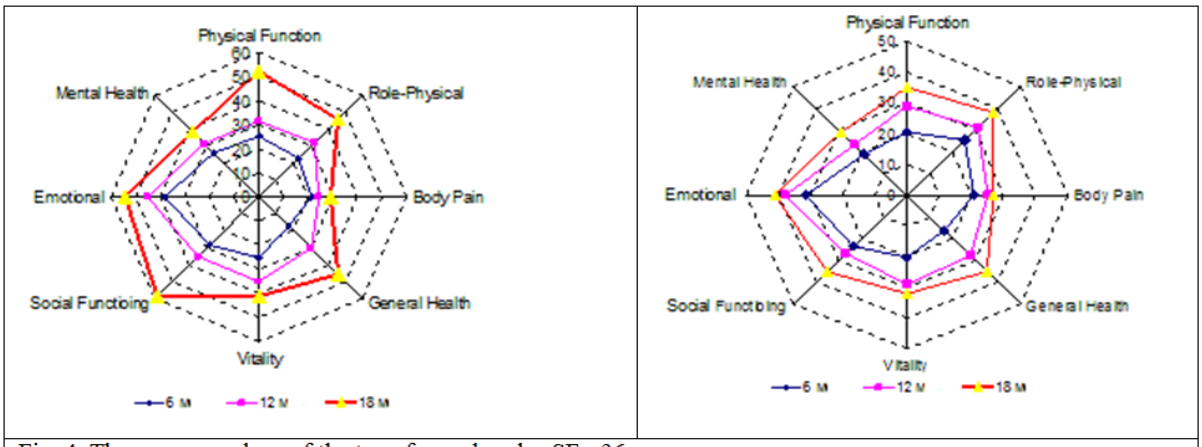


Fig. 4. The average values of the transformed scales SF - 36
a - the main group; b - the comparison group.

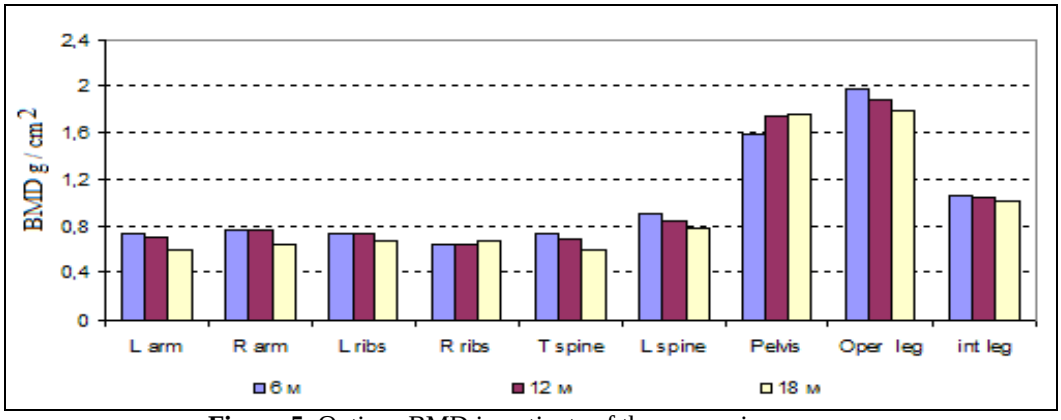


Figure 5. Options BMD in patients of the comparison group

These radiation monitoring in patients of the control group at the stage of 6 months showed the formation of areas of illumination mostly in peri-implant 1st and 7th zones of Gruen. At stage 12 and 18 months were observed similar changes in the 2nd and 6th zones of Gruen. On spondylograms,patients in the control group in dynamics, observed progression of kyphosis in the thoracic spine with the rearrangement of the vertebrae in the form of biconcave deformation degree 2 of Genant. At the same time in the main group, demineralization process how in operated limb thus in spine were less intense (Fig. 5).

Analysis of the data of X-ray absorptiometry in the "body" after 6 months of surgery in patients of the comparison group showed a significant decrease in BMD in all segments of the skeleton (Figure 5), the most extensive changes occurred in the thoracic spine and in operated limb that on average for the group ranged from - 3.39 to -6.22%, which was significantly higher compared to the main group of patients ($p < 0,05$). Assessment of similar parameters in patients of the main group revealed stabilization of BMD and even some of its increased as compared to baseline values, in particular up to 1.2% in the upper limbs and up to 2.3% in the not operated lower limb (Figure 6)

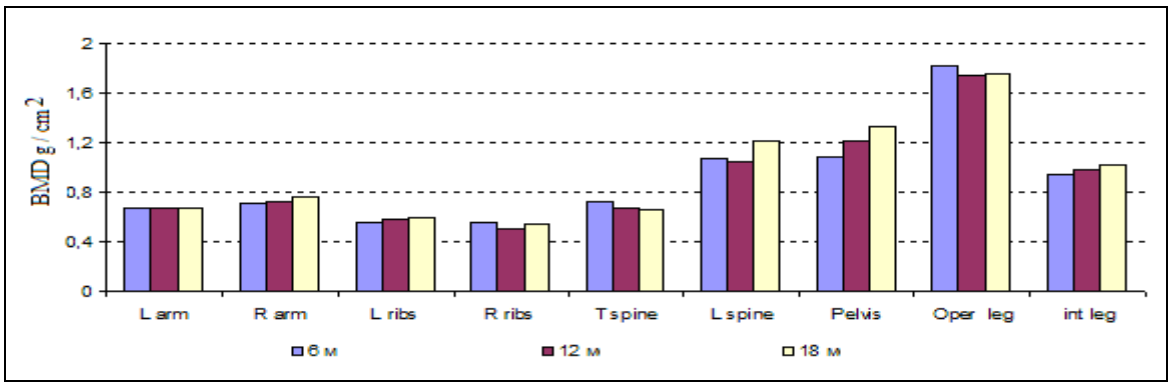


Fig. 6. Options BMD in patients of the main group

IV. Discussion

Arthroplasty involves alteration of bone in peri-implant zone that starts the local and systemic inflammatory responses, which in turn affects the local and systemic mineral homeostasis.

Bone resorption, in the peri-implant zone, is the response to the new force vectors in segment of a compensated bone metabolism, leads to a redistribution of adequate bone mineral density in meta-epiphysis of the proximal femur.

However, a study conducted on a population of patients undergoing arthroplasty in the background of subcompensated bone metabolism, shows that the implementation of surgery, as well as the related forced immobilization of the limb leads to decompensation of mineral homeostasis, which adversely affects the efficiency of motor rehabilitation in early and the late postoperative period.

An analysis of clinical parameters and radiation monitoring in patients of the main group testified to stabilize BMD and optimal recovery of the quality of life of patients at the stage of 3 months of observations, which proves the effectiveness of short-course complex of antiresorptive therapy in the postoperative period, and undoubtedly proves the need for further validation of the effectiveness of such a morphological therapy that will be reflected in our future work.

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