The role of radionuclide method in predicting implant-associated complications of patients with deforming osteoarthrosis of the hip and knee joints

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Introduction

In recent years, the issue of dystrophic-degenerative and infectious-inflammatory diseases of the hip and knee joints has become very important. This fact is associated with the intensification of the static pressure on the joints of the lower extremities and the deterioration of the demographic situation in the country, as well as an increase in the number of elderly patients who make up the bulk of patients with deforming osteoarthrosis of the hip and knee joints [1, 5]. The arthroplasty is a revolution in the therapeutic tactics of degenerative and dystrophic damages of the hip and knee joints. Applying this technique, patients with deforming osteoarthrosis quickly return functional activity, social and work ability [6]. The arthroplasty of the hip and knee joints of patients for deforming osteoarthritis is a modern radical method of orthopedic correction, which quickly returns lost physical activity and improves the quality of life [7].

At the present stage, the diagnostic role of additional methods of radial visualization of degenerative-dystrophic diseases of the hip and knee joints in patients undergoing arthroplasty is actively studied. According to the scientific literature, the basic methods of beam imaging: X-ray, computer tomography (CT), magnetic resonance imaging (MRI), ultrasound and compulsory clinical analyzes in the preoperative period are not enough to detect the reactivity of the osteoblastic activity of the pathological process [9]. Therefore, at the present stage, bone scintigraphy is actively used in the diagnostic and therapeutic process in order to visualize dystrophic-degenerative and infectious-inflammatory lesions of the hip and knee joints [2, 3]. It should be noted that, like other methods of beam imaging, bone

scintigraphy allows remotely, without damage to the surface of the skin and humoral and trophic mechanisms, to monitor many systems of the human body. This method of beam imaging allows us to fully apply system monitoring of the functional state of many organs and systems. Also, with bone scintigraphy it is possible to obtain a quantitative description of metabolic changes and morphological status of the organism, which distinguishes this method from other methods of beam imaging [11].

At the same time, problems with the determination of bone scintigraphy radionuclide parameters that permit arthroplasty without the risk of postoperative complications and the early prediction of implant-associated complications of the hip and knee joints of patients with deforming osteoarthrosis remain unexplained [4, 8].

The above resulted in the need for in-depth study and solving the following problem: early prediction of paraprosthesis complications in patients with deforming osteoarthritis of the hip and knee joints [12]. The problem was solved by analyzing the diagnostic informativeness of the basic methods of radiation diagnostics in order to find the most sensitive instrumental method by which it is possible to develop radionuclide parameters that will allow predicting the occurrence of paraprostheses in the preoperative period. In turn, the definition of the entire spectrum of diagnostic measures can contribute to the development of an algorithm for diagnostic and treatment tactics and early prediction of implant-associated complications [9, 10].

The aim of this work is to determine the diagnostic role of radionuclide method in predicting of implant-associated complications of patients with deforming osteoarthrosis of the hip and knee joints.

Materials and investigation methods

The work is based on the results of retrospective data from clinical and instrumental studies conducted between 2005 and 2015. The main group is represented by 455 patients with lesions of hip and knee joints of different genesis (including 274 women and 181 men), aged 17 to 85 years. The average age of the examined patients was 57.2±12.4. The average age of the examined women was 51.7±11.3 and male - 61.4±11.3 years. The total number of controls in the group was 102, of which 62 women and 40 men, 25 to 73 years old, the mean age was 58.3±9.3. The control group was represented by patients who had no complaints and clinical symptoms, which are characteristic of lesions of the hip and knee joints.

For all patients, bone scintigraphy was performed according to the standard protocol [11]:

Stage I – angiographic phase; Was performed immediately after intravenous bolus injection of 600-800 MBq of 99mTc-methylenediophosphonate (99mTc-MDP); collection of information for 120 s.

Stage II – early static phase; was performed in a static mode immediately after angiographic phase collection (120 s);

Stage III – delayed static phase; was carried out 2-4 hours after the introduction of radiopharmaceutical, was performed in static mode.

After receiving the images and performing standard computer diagnostic information processing operations, they performed a visual assessment of the studied areas. Each of the patients found one or several sites of high-level fixation of radiopharmaceutical; the total number of them was 592. The sites were localized mainly in the projections of the structures of the articular complexes of the hip and knee joints, as well as in the projection of the proximal regions of the femur and tibia. The shape, size and intensity of the visualization of the plots varied widely. The nature of each of the cells was clearly determined by the results of clinical, instrumental (study of anamnesis, objective status, laboratory data) and radiation (X-ray, CT, ultrasound examination, MRI) methods, confirmed by repeated scintigraphic examinations. In order to analyze information, all foci are divided into groups that are arranged in order of increasing the intensity of bone injury, aggressiveness of pathological changes: 1st group – avascular necrosis; 2nd group – deforming osteoarthritis; 3rd group – post-traumatic osteoarthritis; 4th group – rheumatoid arthritis.

Results

To detect the features of the metabolic state of foci of increased fixation of radiopharmaceutical of different nature, three-phase bone scintigraphy was applied. All patients performed three-phase bone scintigraphy according to the standard protocol. After receiving the images and performing standard computer diagnostic information processing operations, they performed a visual assessment of the studied areas. Each of the patients found one or several sites of high-level fixation of radiopharmaceutical; the total number of them was 592. The sites were localized mainly in the projections of the structures of the articular complexes of the hip and knee joints, as well as in the projection of the proximal regions of the femur and tibia. Their initial definition was carried out on the image of the 3rd stage of three-phase bone scintigraphy, that is, with maximum contrast of bone tissue. The shape, size and intensity of the visualization of the plots varied widely. The nature of each of the cells was clearly determined by the results of clinical and instrumental (anamnesis, objective status, laboratory data) and radiological (X-ray, CT, ultrasound, MRI) methods, confirmed by repeated scintigraphic examinations. In order to analyze information, all foci are divided into groups that are arranged in order of increasing the intensity of bone injury, aggressiveness of pathological changes: 1st group – avascular necrosis; 2nd group – deforming osteoarthritis; 3rd group – post-traumatic osteoarthritis; 4th group – rheumatoid arthritis (table 1).

After visual evaluation of the obtained data, the kinetic parameters were calculated for each phase of three-phase bone scintigraphy: angiography phase, early static phase and delayed static phase. The

Table 1.
Distribution of pathological area in joint structures depending on their nature.

Indicator	1-st group	2-nd group	3-rd group	4-th group	Total
Number of area	154	197	125	116	592
Percentage (%)	26,0	33,2	21,1	19,7	100

analysis of the data included the construction of the angiographic curve and the calculation of the mean values of kinetic indices. The relative accumulation coefficient (P) in the angiographic phase, which corresponded to the arterial inflow in the investigated cell, increased in each of the following groups, relative to the previous one (in the 1st group it was 2.76 ± 0.28 imp / cm2, in the 2nd group – 3,12 ± 0,54 imp / cm2, in the 3rd group – 3,31 ± 0,63 imp / cm2, in the 4th group – 3,99 ± 0,41 imp / cm2). Such dynamics indicated an increase in total arterial inflow, respectively, in the activity of metabolic processes in the cell.

The results of the analysis of the kinetic parameters of the angiographic phase bone scintigraphy are given in table. 2.

Angular coefficient (a) characterizes the peak of the angiographic curve in the phase of equilibrium concentration or the rate of fixation of radiopharmaceutical in the first minutes after it enters the hearth. For all types of pathological lesions, this parameter was greater than the control group value, but its probable differences in different groups were not observed. The initial ordinate (b) described the volume of blood supplied to the hearth. This indicator correlated with the specific maximum accumulation of radiopharmaceutical at the 1st stage of bone scintigraphy, since it reflected the inflow of arterial blood in the investigated cell. There was a gradual increase in the average value of b in the following groups. The area under the angiographic curve ($F_{I\Sigma}$) reflected the integral perfusion of the hearth, which was established after the end of the venous outflow. This indicator was calculated only in the second minute of angiographic phase, when it fully included the phase of equilibrium concentration. $F_{I\Sigma}$ was moderately increased in foci in avascular necrosis and deform-

Table 2.
Analysis of kinetic indices of the angiographic phase of bone scintigraphy.

Indicator	Control	1-st group	2-nd group	3-rd group	4-th group
$F_{I(10^5)(cm^{-2})}$	$4,11 \pm 0,74$ p_{C-IV}*	$4,32 \pm 0,69$	$4,47 \pm 0,71$	$5,08 \pm 0,79$	$5,82 \pm 0,83$
P_I (imp/cm²)	$2,64 \pm 0,26$ p_{C-IV}*	$2,76 \pm 0,28$ p_{I-IV}* p_{I-III}*	$3,12 \pm 0,54$	$3,31 \pm 0,63$	$3,99 \pm 0,41$
A_I	$1,05 \pm 0,08$ p_{C-IV}*	$1,07 \pm 0,09$ p_{I-IV}*	$1,20 \pm 0,22$	$1,38 \pm 0,27$	$1,68 \pm 0,39$
$a (10^3)$ $(импхс^{-1})$	$11,61 \pm 3,07$ p_{C-II}* p_{C-IV}*	$14,13 \pm 2,64$	$18,07 \pm 4,38$	$13,94 \pm 2,88$	$17,14 \pm 4,12$
b (imp)	$2,32 \pm 0,21$ p_{C-III}* p_{C-IV}*	$3,29 \pm 0,58$	$3,18 \pm 0,42$	$3,51 \pm 0,62$	$3,84 \pm 0,65$
$F_{I\Sigma}$	$81,45 \pm 2,87$ p_{C-I}* p_{C-II}* p_{C-III}* p_{C-IV}*	$108,65 \pm 4,31$ p_{I-IV}*	$109,19 \pm 4,41$ p_{II-IV}*	$114,38 \pm 4,54$	$125,52 \pm 4,70$

*Notes: * p <0,05 – the reliability of the differences between the relevant indicators. F_I – specific maximum accumulation of radiopharmaceutical in the cell in phase I bone scintigaphy; P_I – coefficient of relative accumulation in the cell in the first phase of the bone scintigraphy; A_I – asymmetry of accumulation of radiopharmaceutical in the I phase of bone scintigraphy in the pathological hearth and symmetrical intact area; parameters of quasi-linear approximation of the phase of equilibrium concentration angiographic curve (a – angular coefficient; b – initial ordinate); $F_{I\Sigma}$ - area under the angiographic curve.*

ing osteoarthrosis (108.65 ± 4.31 and 109.19 ± 4.41 im x c, respectively), significantly increased in foci in post-traumatic osteoarthritis and rheumatoid arthritis (114.38 ± 4.54 and 125.52 ± 4.70 imp / s, respectively) compared with the control group (81.45 ± 2.87 imp / s). In analyzing the parameters of the angiographic phase, it was established that the coefficient of relative accumulation of radiopharmaceutical and area under $F_{I\Sigma}$ was the most dynamically changed - these calculation parameters were gradually increased in the following groups of studies, which indicated an increase in arterial inflow and integral blood filling in the centers, in proportion to Intensity of damage and aggressiveness of pathological changes. The asymmetry parameter was characterized by the activity of blood flow, tissue blood flow and accumulation of radiopharmaceutical in the pathological center, compared to the symmetric intact area. In the control group, the asymmetry did not exceed the error value. At the same time, it tended to increase in each of the following groups. With aseptic lesions, the asymmetry was relatively low in all phases of the survey. As a result of active metabolic changes in deforming osteoarthrosis, post-traumatic arthrosis and rheumatoid arthritis, there was a significant increase in the fixation of radiopharmaceutical in these cells, as compared with symmetrical sites. The maximum value of the asymmetry of fixation of radiopharmaceutical in angiographic phase was determined by rheumatoid arthritis, which indicated a more intense flow of blood into such centers, compared with a symmetrical intact site. In rheumatoid arthritis, the maximum asymmetry was also noted in delayed static phase, which indicated an intensive fixation of the drug in them. In the radiopharmaceutical, which characterized mainly the soft tissue component, there was a decrease in asymmetry in the 2nd, 3rd and 4th groups of centers.

Table 3.
The analysis of the kinetic parameters of the early and delayed static phase of bone scintigraphy.

Indicator	Control	1-st group	2-nd group	3-rd group	4-th group
F_{II} (10^7) (cm^{-2})	$3,11 \pm 0,23$ $p_{C-IV}*$	$4,11 \pm 0,46$ $p_{I-II}*$	$3,18 \pm 0,19$ $p_{II-IV}*$	$3,38 \pm 0,21$ $p_{III-IV}*$	$4,52 \pm 0,57$
F_{III} (10^7) (cm^{-2})	$2,42 \pm 0,51$ $p_{C-IV}*$	$3,27 \pm 0,26$ $p_{I-IV}*$	$4,04 \pm 0,38$ $p_{II-IV}*$	$3,92 \pm 0,29$ $p_{III-IV}*$	$5,41 \pm 0,44$
P_{II} (imp/cm^2)	$61,32 \pm 3,11$	$61,51 \pm 3,12$	$49,22 \pm 2,02$ $p_{II-IV}*$	$57,71 \pm 2,50$ $p_{III-IV}*$	$78,57 \pm 4,21$
P_{III} (imp/cm^2)	$34,77 \pm 1,83$ $p_{C-II}*$ $p_{C-III}*$ $p_{C-IV}*$	$52,51 \pm 2,24$ $p_{I-III}*$ $p_{I-IV}*$	$60,11 \pm 3,09$	$67,37 \pm 3,48$	$79,13 \pm 4,32$
Ir (%)	$-27,32 \pm 1,15$ $p_{C-II}*$ $p_{C-III}*$ $p_{C-IV}*$	$-26,97 \pm 1,14$ $p_{I-II}*$ $p_{I-III}*$ $p_{I-IV}*$	$16,67 \pm 0,79$	$18,79 \pm 0,88$	$21,18 \pm 1,12$
A_{II}	$1,00 \pm 0,08$	$1,13 \pm 0,13$	$1,10 \pm 0,09$	$1,35 \pm 0,17$	$1,37 \pm 0,18$
A_{III}	$1,00 \pm 0,08$ $p_{C-III}*$ $p_{C-IV}*$	$1,25 \pm 0,15$ $p_{I-III}*$ $p_{I-IV}*$	$1,61 \pm 0,22$ $p_{II-III}*$ $p_{II-IV}*$	$2,37 \pm 0,55$	$2,94 \pm 0,87$

*Notes: * p <0,05 – the reliability of the differences between the relevant indicators. F_{II}, F_{III} – specific accumulation of radiophrmaceutical in the cells in II and III phases of bone scintigraphy; P_{II}, P_{III} – coefficient of relative accumulation in the cell in II and III phases of bone scintigraphy, respectively; A_{I}, A_{II} – asymmetry of accumulation of radiophrmaceutical in a pathological cell and symmetrical intact section in II and III phases of bone scintigraphy, respectively; Ir – retention index (%).*

The specific accumulation index (F) of radiopharmaceutical reflected the intensity of the indicator fixation in the center, normalized to the area, and the entered activity. When interpreting early static phase data and delayed static phase of bone scintigraphy, specific accumulation ($F_{II} > F_{III}$) was decreased in foci with aseptic arthritis, similar to the control group, indicating a slight difference in the activity of metabolic processes in them from the normal process of remodulation in the articular structures. In active deforming osteoarthrosis, in posttraumatic centers and foci at rheumatoid arthritis, the rupture of radiopharmaceutical was not performed, therefore, the specific accumulation of the drug increased with time ($F_{II} < F_{III}$). The value of the relative accumulation coefficient (P), which characterized the absolute amount of the indicator in the area, regardless of the amount of drug administered, in the early static phase and delayed static phase had similar values with the index F. The index of retention index (II) described the delay of the drug in the bone tissue of the articular structures. In cells with aseptic necrosis, as in the control group, Ir was negative – in the delayed static phase, the intensity of fixation of the drug was less than that of early static phase. However, the retention of radiopharmaceutical in foci at deforming arthrosis, post-traumatic osteoarthrosis and rheumatoid arthritis was significantly higher and amounted to 16.67 ± 0.79 %, 18.79 ± 0.88 % and 21.18 ± 1.12 %, respectively (p <0.05).

The results of the analysis of the kinetic parameters of the angiographic phase of bone scintigraphy are presented in table 3.

Consequently, in analyzing the quantitative parameters of the angiographic phase, early static phase, and delayed static phase results, patterns of fixation of radiopharmaceutical in dynamics in pathological cells of articular structures of different nature were revealed. Thus, an increase in the intensity of blood flow in acute deforming arthrosis, post-traumatic processes and rheumatoid arthritis in angiographic phase indicated the intensification of arterial blood supply to such centers due to active inflammation, the influence of an infectious agent or increased osteolytic activity. Integral perfusion of sites with degenerative-dystrophic changes and osteonecrosis exceeded the control group's parameters due to hyperemia, tissue edema and the influence of inflammatory mediators. In the area of rheumatoid arthritis, the blood filling of the tissues was significantly higher due to increased vascular permeability, as a result of the action of infectious agents, activa-tion of factors of resorption and synthesis of mineral components, angiogenesis.

The washing of radiopharmaceutical from different sites by nature also had its own distinctive features: avascular cells behaved similarly to normal bone tissue without delaying the drug. The retention of radiopharmaceutical was increased in post-traumatic osteoarthrosis and rheumatoid arthritis, indicating a high extractivity of such centers. The asymmetry of radiopharmaceutical fixation in the pathological cell and symmetric intact area was also increased for the 3rd and 4th groups of pathological sites, which was indicative of a more intensive drug delay in them. In order to determine the reliability of the differences in the obtained kinetic indices for cells of different nature, the correlation of the statistical probability of their difference in the studied groups was analyzed. Each parameter was compared to that of the same group. According to the statistical analysis, it should be noted that the avascular cells differed significantly from the centers in the deforming and post-traumatic arthrosis only by the index of retention index and the asymmetry of the fixation in delayed static phase. In the angiographic phase there were no significant differences for these groups of centers. The parameters of angiograms of arthritic centers also did not have significant differences from other cells, except for areas with rheumatoid arthritis. $F_{I\Sigma}$ for the 4th group significantly exceeded the indicators of control, 1st and 2nd groups of centers (p <0,05). In post-traumatic osteoarthrosis, this indicator, despite the high average, did not differ significantly from other sites, except for the control group. The coefficient of relative accumulation of radiopharmaceutical in angiographic phase also had a significant difference for rheumatoid arthritis compared with the control group, 1 and 2 groups of cells (p <0.05). For the 4th and all other groups, the values of specific accumulation of radiopharmaceutical in early static phase (p <0,05) and delayed static phase (p <0,05) significantly differed. It was also important to determine the retention index, which had credible differences in the centers of deforming and post-traumatic osteoarthritis, rheumatoid arthritis (p <0.05).

The asymmetry of the accumulation of radiopharmaceutical in the pathological focus and the symmetric intact site in the delayed static phase significantly differed in all groups, except for the 3rd and 4th group of centers. This indicator in angiographic phase was statistically significantly higher for rheumatoid arthritis, and in early static phase -
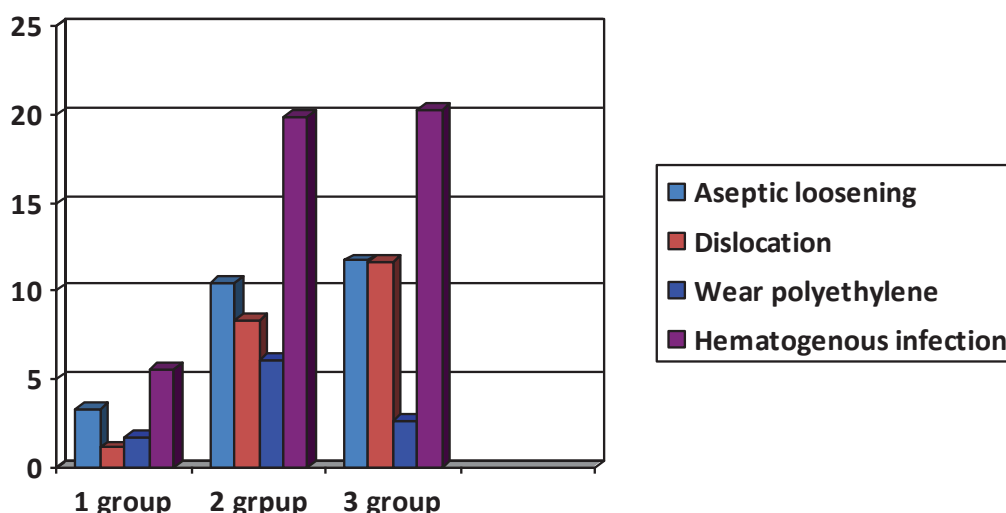
Fig. 1. *Distribution of diagnosed implant-associated complications in groups of radionuclide parameters of bone scintigraphy.*

the indices in the groups between them statistically did not differ. In general, the greatest number of significantly different indicators in all three phases was observed between centers in rheumatoid arthritis and sites with aseptic necrosis and deforming osteoarthritis, with static phases being more informative. The parameters of angiographic phase had significant differences only in groups with the most different metabolic processes - in aseptic foci and foci at rheumatoid arthritis.

Summing up the obtained results, we can conclude that calculating the quantitative indices of the kinetics of radiopharmaceutical at different stages of bone scintigraphy allowed to determine statistically significant differences in metabolic changes in focal lesions in the articular structures and, accordingly, to increase the differential-diagnostic capabilities of the radionuclide method of examination of patients with hip and knee arthroplasty.

According to the results of preoperative static bone scintigraphy all patients were divided into three groups of radionuclide parameters of bone scintigraphy.

In the first group of radionuclide parameters of scintigraphy – fixation of radiopharmaceutical in the area of defeat of the articular complex was (-50 %) - (+170 %). This group consisted is 165 patients.

In the second group of radionuclide parameters of bone scintigraphy – fixation of radiopharmaceutical in zone of injury of the articular complex was (+171 %) - (+350 %). This group is 172 patients.

In the third group of radionuclide parameters of bone scintigraphy – hyperfixation of radiopharmaceutical in the area of the defeat of the articular

complex was more than (+350%). This group is 118 patients.

The analysis of diagnosed implant-associated complications in the groups of parameters of bone scintigraphy is shown in figure 1.

In the 2nd and 3rd diagnostic group, the parameters of radiopharmaceutical fixation, the number of cases of implant-associated complications in the area of joint damage in 1 year after arthtoplasty, the number of corresponding complications in the patients of the I group of fixation of radiopharmaceutical in the area of the affected articular complex was likely to prevail (p <0.05)

Positive correlation was found between the scintigraphic parameters of inclusion of radiopharmaceutical for arthroplasty and scintigraphy parameters in postoperative implant-associated complications, namely: between bone scintigraphy indices in degenerative-dystrophic processes and radionuclide parameters in dislocation of endoprosthesis components (r = 0.585; p <0.05); radionuclide parameters in avascular necrosis and scintigraphy parameters in aseptic fractures of endoprosthesis components (r = 0.639; p <0.05); indices in rheumatoid arthritis and scintigraphy in cases of acute hematogenic articular infection (r = 0.409; p <0.05).

According to the results of the analysis of the indicators in the groups of patients, according to the initial diagnosis, the radionuclide parameters at the preoperative stage, at which the risk of developing implant-associated complications decreased, are as follows: with aseptic necrosis – the inclusion of radiopharmaceutical in the cells of the affected articular structures – within (- 10 %) - (-50%), with

Table 4.
Diagnostic informative analysis of radial visualization methods in differential diagnosis of deforming osteoarthritis of the hip and knee joints.

Method of study	Sensitivity, %	Specificity,%	Accuracy, %
X-ray	62,5	67,1	65,8
Ultrasound	80,7	82,5	85,2
CT	88,2	92,1	89,3
MRI	90,7	94,6	91,4
Thermography	83,2	56,8	74,3
Three phase bone scintigraphy	93,4	83,3	88,6

deforming osteoarthrosis – (+ 10%) - (+ 110%), in post-traumatic osteoarthritis – (+ 10%) - (+150%); at rheumatoid arthritis – (+ 10%) - (+170%). Comprehensive study of hip and knee joints, including classical X-ray, ultrasound, CT, MRI and bone scintigraphy greatly expands the diagnostic capabilities of differential diagnosis of deforming osteoarthrosis of the hip and knee joints. In connection with this, an assessment of the diagnostic informativeness of the above-mentioned methods of beam imaging was carried out in order to find a sensitive instrumental visualization method, with the help of which early prediction of implant-associated complications is possible.

Analysis of the data of diagnostic informativeness of the methods of beam imaging in the differential diagnosis of deforming osteoarthrosis of the hip and knee joints is given in table 4.

According to the results of the analysis, the diagnostic informativity of bone scintigraphy in detecting deforming osteoarthrosis of the hip and knee joints exceeded the results of X-ray and thermography and was: sensitivity 93.4 %, 62.5 % and 83.2 %, respectively ($p < 0.05$); specificity – 83.3 %, 67.1 % and 56.8 %, respectively ($p < 0.05$); accuracy – 88.6 %, 65.8 % and 74.3%, respectively ($p < 0.05$). Thus, bone scintigraphy has greater sensitivity and accuracy (93.4 % and 88.6 %) than X-ray (62.5 % and 65.8 %), ultrasound (80.7 % and 85.2 %), thermography (83.2 % and 74.3 %) respectively. However, CT and MRI have higher specificity (92.1 % and 94.6 %), in relation to bone scintigraphy (83.3 %), respectively (fig. 2).
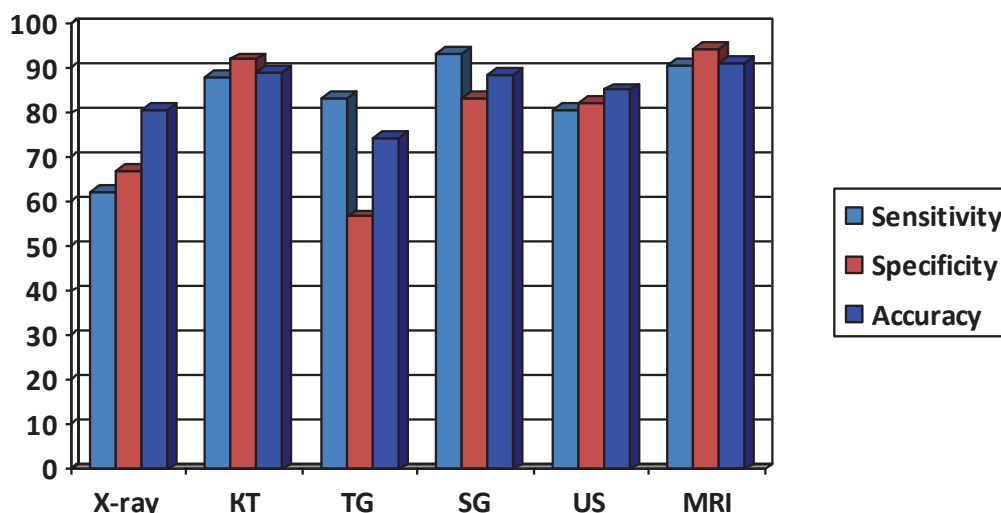

Fig. 2. *Diagnostic informativeness of methods of instrumental visualization in differential diagnostics of deforming osteoarthrosis of the hip and knee joints.*

Conclusion

The kinetics of osteotropic radiopharmaceuticals in the area of fixation of damaged hip and knee joints in infectious-inflammatory processes is characterized by a statistically significant preponderance of retention (t = 3.29; p <0.05) and specific accumulation of the drug in the early static phase (t = 2.23 ; P <0.05) and the delayed static phase of tree-phase bone scintigraphy (t = 2.36; p <0.05) compared with the centers of fixation of radiopharmaceutical in deforming osteoarthrosis, which correlates with the differences in the destructive-reparative processes in them.

The probable increase in arterial inflow (t = 2,48; p <0,05) and integral perfusion at bone scintigraphy (t = 2,65; p <0,05) occurs in the centers of hyperfection of radiopharmaceutical with infectious and inflammatory processes, due to the intensification of osteoblastic activity and angiogenesis in them, in comparison with degenerative-dystrophic centers of fixation of radiopharmaceutical.

In the differential diagnosis of deforming osteoarthritis of the hip and knee joints, bone scintigraphy has greater sensitivity and accuracy (93.4 % and 88.6 %) than X-ray (62.5 % and 65.8 %), ultrasonography (80.7 % and 85.2 %), thermography (83.2 % and 74.3 %) respectively. However, CT and MRI have greater specificity (92.1 % and 94.6 %) in relation to bone scintigraphy (83.3%), respectively.

Radionuclide differential-diagnostic parameters of bone scintigraphy, which reduces the risk of implant-associated complications of patients with deforming osteoarthrosis of the hip and knee joints, are as follows: with aseptic necrosis – the inclusion of radiopharmaceutical in the cells of the affected articular structures – within (-10%) – (- 50%); with deforming osteoarthritis - (+10%) – (+110%); in post-traumatic osteoarthritis – (+ 10%) - (+150%); at rheumatoid arthritis – (+ 10%) - (+170%).

There was established a positive correlation between the radionuclide parameters of bone scintigraphy and the arthroplasty, and the parameters of bone scintigraphy in implant-associated complications in the postoperative period, namely: between the parameters of scintigraphy in degenerative-dystrophic processes and radionuclide parameters in dislocations of the components of the endoprosthesis (r = 0.585; t = 3.6; p <0.05); between scintigraphy indices in avascular necrosis and radionuclide parameters in aseptic fractures of endoprosthesis components (r = 0.639; t = 4.2; p <0.05); between scintigraphy indices in rheumatoid arthritis and radionuclide parameters in hematogenic articular infection (r = 0.409; t = 2.6; p <0.05).

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THE ROLE OF RADIONUCLIDE METHOD IN PREDICTING IMPLANT-ASSOCIATED COMPLICATIONS OF PATIENTS WITH DEFORMING OSTEOARTHROSIS OF THE HIP AND KNEE JOINTS

P. Korol

Purpose – to determine the diagnostic role of radionuclide method in predicting of implant-associated complications of patients with deforming osteoarthrosis of the hip and knee joints.

Materials and methods. The main group is represented by 455 patients with lesions of hip and knee joints of different genesis (including 274 women and 181 men), aged 17 to 85 years. The average age of the examined patients was 57.2±12.4. For all patients, bone scintigraphy was performed according to the standard protocol including tree phase: angiographic phase, early static phase, delayed static phase.

Results. In this work theoretically grounded problem diagnostic role of radionuclide methods in predicting implant–associated complications in patients with deforming osteoarthrosis of the hip and knee joints. Kinetic osteotropic radiopharmaceuticals in the cells of fixing damaged hip and knee joints in inflammatory processes characterized by statistically significant predominance retention and specific accumulation of the drug in the early static and deferred static phase, three-phase scintigraphy compared with areas of fixing radiopharmaceuticals degenerative processes that correlate with differences destructive-reparative processes them.

Conclusion. The probable increase in arterial inflow and integral perfusion at bone scintigraphy occurs in the centers of hyperfection of radiopharmaceutical with infectious and inflammatory processes, due to the intensification of osteoblastic activity and angiogenesis in them, in comparison with degenerative-dystrophic centers of fixation of radiopharmaceutical. In the differential diagnosis of deforming osteoarthritis of the hip and knee joints, bone scintigraphy has greater sensitivity and accuracy than X-ray, ultrasonography, thermography, respectively. However, CT and MRI have greater specificity in relation to bone scintigraphy, respectively.

Key words: osteoarthrosis, bone scintigraphy, hip and knee joint, arthroplasty, implant-associated complications.

РОЛЬ РАДІОНУКЛІДНОГО МЕТОДУ В ПРОГНОЗУВАННІ ІМПЛАНТ-АСОЦІЙОВАНИХ УСКЛАДНЕНЬ ПАЦІЄНТІВ НА ДЕФОРМУЮЧИЙ ОСТЕОАРТРОЗ КУЛЬШОВИХ ТА КОЛІННИХ СУГЛОБІВ

П.О. Король

Мета – визначити діагностичну роль радіонуклідного методу у прогнозуванні імплант-асоційованих ускладнень хворих на деформуючий остеоартроз кульшових і колінних суглобів.

Матеріали та методи. Основну групу представлено 455 пацієнтами з ураженням кульшових та колінних суглобів різного генезу (у тому числі 274 жінок та 181 чоловіків) у віці від 17 до 85 років. Середній вік досліджуваних пацієнтів склав 57,2 ± 12,4. Для всіх пацієнтів трьохфазова остеосцинтиграфія була виконана за стандартним протоколом та включала три фази: ангіографічну фазу, ранню та відстрочену статичну фазу.

Результати. В роботі розглянуто та теоретично обґрунтовано проблему діагностичної ролі радіонуклідного методу у прогнозуванні імплант-асоційованих ускладнень пацієнтів на деформуючий остеоартроз кульшових та колінних суглобів. Кінетика остеотропних радіофармпрепаратів в осередках фіксації уражених кульшових та колінних суглобів при інфекційно-запальних процесах характеризується статистично вірогідним переважанням

ретенції та питомого накопичення препарату в ранній статічній та відстроченій статічній фазі трьохфазової остеосцинтиграфії, порівняно з вогнищами фіксації препарату дегенеративно-дистрофічних процесів, що корелює з відмінностями деструктивно-репаративних процесів у них.

Висновки. Вірогідне зростання показників артеріального притоку та інтегральної перфузії при сцинтиграфії відбувається у вогнищах гіперфіксації радіофармпрепарату при інфекційно-запальних процесах за рахунок інтенсифікації в них остеобластичної активності і ангіогенезу, у порівнянні з дегенеративно-дистрофічними осередками фіксації індикатору. В диференціальній діагностиці деформуючого остеоартрозу кульшових та колінних суглобів, метод трьохфазової остеосцинтиграфії має більшу чутливість та точність ніж методи рентгенографії, УЗД, термографії, відповідно; однак методи КТ та МРТ мають більшу специфічність, по відношенню до сцинтиграфії, відповідно.

Ключові слова: остеоартроз, остеосцинтиграфія, кульшові та колінні суглоби, ендопротезування, імплант-асоційовані ускладнення.

РОЛЬ РАДИОНУКЛИДНОГО МЕТОДА В ПРОГНОЗИРОВАНИИ ИМПЛАНТ-АССОЦИИРОВАННЫХ ОСЛОЖНЕНИЙ У ПАЦИЕНТОВ ДЕФОРМИРУЮЩИМ ОСТЕОАРТРОЗОМ ТАЗОБЕДРЕННЫХ И КОЛЕННЫХ СУСТАВОВ

П.А. Король

Цель – пределить диагностическую роль радионуклидного метода в прогнозировании имплант-ассоциированных осложений больных с деформирующим остеортрозом.

Материалы и методы. Основную группу представлено 455 пациентами с поражением тазобедренных и коленных суставов разного генеза(в том числе 274 женщин и 181 мужчина в возрасте от 17 до 85 лет. Средний возраст исследованных пациентов составлял 57,2 ± 12,4. Для всех пациентов трехфазовая остеосцинтиграфия была выполнена по стандартному протоколу и составляла три фазы: ангиографическую фазу, раннюю и отсроченную статическую фазу.

Результаты. В работе рассмотрено и теоретически обосновано проблему диагностической роли радионуклидного метода в прогнозировании имплант-ассоциированных осложнений пациентов с дформирующим остеоартрозом тазобедренных и коленных суставов. Кинетика остеотропных радиофармпрепаратов в очагах фиксации пораженных тазобедренных и коленных суставов при инфекционно-воспалительных процессах характеризуется статистически достоверным преобладанием ретенции и удельного накопления препарата в ранней и отсроченной статической фазе трехфазовой остеосцинтиграфии, по сравнению с очагами фиксации преперета при дегенеративно-дистрофических процессах, что кореллирует с отличиями дегенеративно-дистрофических процессов в них.

Выводы. Достоверное возрастание показателей артериального притока и интегральной перфузии при сцинтиграфии происходит в очагах гиперфиксации радиофармпрепарата при инфекционно-воспалительных процессах за счет интенсификации в них остеобластической активности и ангиогенеза, в сравнении с дегенеративно-дистрофическими очагами фиксации радиофармпрепарата. В дифференциальной диагностике деформирующего остеоартроза тазобедренных и коленных суставов метод трехфазовой остеосцинтиграфии имеет большую чувсвтительность и точность чем методы рентгенографии, УЗИ, термографии, соответственно.

Ключевые слова: остеоартроз, остеосцинтиграфия, тазобедренные и коленные суставы, эндопротезирование, имплант-ассоциированные осложнения.