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SURGICAL TREATMENT OUTCOMES IN PATIENTS WITH ANKYLOSING SPONDYLARTHROSIS

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ABSTRACT

Research objective: to improve the outcomes of surgical treatment in patients with ankylosing spondyloarthritis.

Materials and research methods. The research included 99 patients with ankylosing spondyloarthritis who underwent total hip arthroplasty in the Department of Adult Orthopedics of the Research Institute of Traumatology and Orthopedics and the Department of Traumatology of the Republican Clinical Hospital No. 1 in the period 2011 to 2020. During the research we used a device designed by us for determining the insertion depth of the acetabular component of the hip implant (utility model patent provided by the Intellectual Property Agency, FAP 2015 0108 dated July 7, 2015). As well we applied a device for hip joints motion development (utility model patent FAP 2016 0077 dated June 17, 2016). The absolute values of the functional state of patients before THA were assessed on the Oberg scale.

Results. According to the results of research, it was established that hip joint dysfunctions depended on the intensity of clinical signs and AS of 3 and 4 stages was the indication for THA. Besides, in the treatment of patients with AS, the use of cementless endoprosthesis allowed to widely implement the method of hip arthroplasty. In cases of patients with AS associated with severe osteoporosis, protrusive coxitis and defects in the acetabulum walls, the operation of choice was THA using bone cement. Alongside with this, during the

surgery, we used the device to determine the depth of the acetabular component, which facilitated the performance of the surgical intervention and reduced postoperative complications.

Conclusion. Evaluation of long-term outcomes of treatment showed that indicators of good results in the core group were significantly higher compared to the control. According to the results, THA in patients with AS, regardless of age, is the effective method of surgical treatment that eliminates pain and improves the patient's quality of life.

Key-words: total arthroplasty, hip joints, dysfunction, endoprosthesis, outcomes.

INTRODUCTION

According to the World Health Organization data, ankylosing spondylarthritis (AS) is a common disease worldwide, as well in our country. Pathology of major joints composes the main part of musculoskeletal system diseases, which can result in hip joints dysfunction, leading to difficulties in walking, and significantly incapacitating for work and social adaptation of patients [1,4,5,7,8,10]. The incidence of AS depends on the frequency of occurrence of the HLA-B27 antigen among the population [14]. The prevalence of the disease ranges from 0.01% to 0.09% [15]. Despite the increasing tendency of surgical methods application, including total hip arthroplasty (THA), still there is a great number of complications and unsatisfactory outcomes [1,2,4,6]. The proposed therapeutic measures in most cases are inefficient for patients. Inadequate treatment leads not only to a work decrement, but also to disability [1,2,6,19].

Therefore, an urgent task in the world of surgical practice is to improve the treatment outcomes of patients with AS, as well as to work out improved methods of surgical treatment that will reduce the number of complications.

In order to achieve high efficiency of surgical treatment in the conditions of THA and rehabilitation of patients, various scientific studies are being carried out. In most cases of AS, TEP often is the operation of choice. To improve the efficiency of TEP, numerous researches are being conducted to work out and update models and types of endoprosthesis [20]. But among all revision surgeries after primary TEP, THA for AS is considered to be the most significant one. The reason for the revision is the bone tissues resorption around the endoprosthesis. Patients' dissatisfaction with the intervention outcomes, and severity of revision surgeries specify the need to search for new methods of surgical intervention and prevention of complications.

The solution to this problem is of significant importance in modern orthopedics. One of the main tasks of modern healthcare is to ensure a radical improvement in the quality of medical services provided to the population for injuries and musculoskeletal system diseases, as well as to carry out complex

targeted measures. The proposed methods of surgical treatment are technically difficult and can't always fully provide endoprosthesis stability. Especially it is obvious in cases of bone and fibrous ankylosis of the hip joint associated with osteoporosis, sometimes requiring the use of alternative constructions.

The conducted scientific researches on the diagnosis, surgical treatment, rehabilitation and prevention of complications of THA obtained a number of scientific results, including the detection of early instability of the components, associated with indistinct determination of the acetabulum depth [3,9, 11,12,18]. It was proved that early diagnosis, symptomatic and specific treatment of AS are the key for successful performance of THA, as well as reduces complications [13,16,17]. It was also determined that a decrease in bone mineral density leads to instability of the hip joint endoprosthesis. Many authors have studied complications in patients with AS after THA.

One of the causes for the frequent components instability of the hip joint endoprosthesis and the requirement for further revision surgery are insufficiently accurate intraoperative determination of the acetabulum depth, joint dysfunction in cases of fibrous and bone ankylosis associated with bone osteoporosis in AS.

RESEARCH OBJECTIVE

The aim of this research is to improve the outcomes of surgical treatment in patients with ankylosing spondyloarthritis.

MATERIALS AND RESEARCH METHODS

The research included 99 patients suffering from AS associated with coxopathy, who underwent THA in the Department of Adult Orthopedics of the Republican Specialized Scientific and Practical Medical Center of Traumatology and Orthopedics and the Department of Traumatology of the Republican Clinical Hospital No. 1 in the period 2011 to 2020. In the first stage of the preoperative planning, patients received conservative treatment of a rheumatologist on the outpatient basis within 2 weeks.

After the normalization of the rheumatoid test indicators, the patients were admitted for the surgical treatment. We have developed a device for determining the insertion depth of the acetabular component of the hip implant, for which we received a utility model patent provided by the Intellectual Property Agency (Device for determining the insertion depth of the acetabular component of the hip implant FAP 2015 0108 07/07/2015) (Fig. 1).

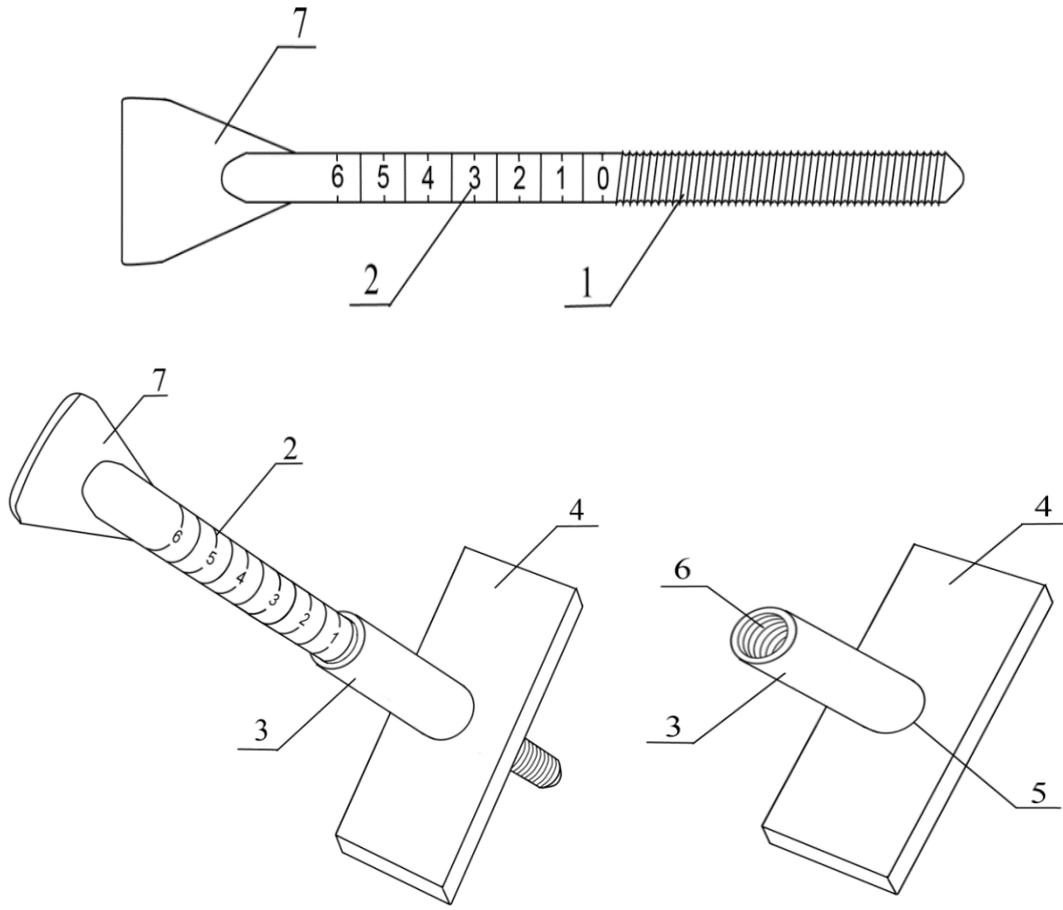


Fig. 1. The device for determining the insertion depth of the acetabular component of the hip implant during the surgery

The proposed device contains a measuring element made in the form of a threaded nail, with a measuring scale on its surface. Comparative analysis with the prototype showed that our proposed device differed from the known by the fact that it was additionally equipped with a plate, containing a hole in the middle part and monolithically installed insertion, with inner surface thread, into which a

threaded nail was screwed equipped with a handle. The device was simplified and easy-to-use and allowed to accurately and quickly determine the insertion depth of the acetabular component during the operation.

All patients were divided into 2 groups - core and control. The core group involved 75 (75.8%) patients. In addition to the traditional method of surgical treatment in this group, we used the device for determining the acetabulum depth during the operation, which allowed to atraumatically, accurately and rapidly determine the depth of the acetabular component of the endoprosthesis. Besides, after the operation, we used a splint for hip joint development. The control group included 24 (24.2%) patients who underwent traditional surgical treatment without using splints for the patients' recovery. The patients' age ranged from 18 to 67, averagely 35 years. Of the total 99 patients, there were 70 men (70.7%), and 29 women (29.3%).

The clinical manifestations of AS were characterized by constant pain, limitation or absence of the joint motion, limb shortening, lameness when walking due to the limb shortening and contracture in the hip joint.

As known AS is more common in young working age, especially among men. The intensity of clinical characteristics in AS in the hip joint area depends on the severity and stage of the disease. Often there are complaints of constant pain of varying intensity in the hip joint area, gradually increasing by the stage of the disease. As the pain intensifies, motion in the hip area is limited. On the basis of the obtained functional results of the study, we can conclude that symptoms such as pain, mobility, walking and lameness reflect the severity of the hip dysfunction, as well they take into consideration its main indicators before THA.

AS is characterized by the fact that after remitting of the inflammatory reaction in the joint, a capsular ligament or proliferative signs in the periarticular tissues (synovial) are always noted, which lead to restriction of movement and dysfunction of the joint.

The examination of the patients was carried out according to a computer program developed by us (patent No. DGU 03454 dated December 17, 2015), considering the pain intensity, joint mobility, and the ability to walk.

Upon admission of patients before THA, we assessed functional studies according to 4 main symptoms: *pain, mobility, walking and lameness of the patient.*

These signs were divided into 6 degrees (Table 1) and were evaluated at 11 and 12 points each. Evaluation of results can be carried out in two ways, in terms of absolute or relative indicators.

We evaluated the absolute values of the total points on the Oberg scale. To assess the functional state of patients before THA, pain characteristics were evaluated according to 4 criteria (from 0 to 6 in descending order, that is, from the absence of pain - 6 points, to pronounced and permanent - 0 points). The degree of hip joint motion was evaluated in the normal condition over 90 °, with abduction up to 30 ° - 6 points, before ankylosis in a vicious position - 0 points. The evaluation of the walking state was carried out from 6 points in the normal condition to inability to walk independently - 0 points. The intensity of lameness was evaluated according to the following: severe lameness - 0 points, absence of lameness - 6 points.

The total points for the indicators of pain, mobility, walking and lameness before surgery were summed up and used when assessing the functional state of the hip joint. Based on this data we determined the indications for surgery.

The result of the total points: 11-12 points - very good; 10 points - good; 9 points - average; 8 points - moderate; 7 and less points - poor. The indication for the surgery was the total of 8, 7 and less points (Table 1).

Table 1

Evaluation of the functional state of patients with AS before surgery

| Pain | Mobility | Walking | Lameness |
|---|--|---|---------------------|
| (6) absence of pain | (6) flexion: over 90 °; abduction: up to 30 ° | (6) norm | (6) None |
| (5) mild or rare pain, normal activity | (5) flexion: 80 - 90 °; abduction: less than 15 ° | (5) without a cane, but with mild lameness | (5) Periodic mild |
| (4) mild pain while walking, quickly disappears during rest | (4) flexion: 60 - 80 °, the patient can reach the foot | (4) with a cane - can walk for a long time; without the cane - for a short time, limping | (4) Mild |
| (3) tolerable pain, limiting activity | (3) flexion: 40 - 60 ° | (3) using one cane for less than 1 hour; with difficulties - without the cane | (3) Weakly moderate |

| | | | |
|---|---|-------------------------|----------------|
| (2) severe pain while walking, excluding any activity | (2) flexion: less than 40 ° | (2) using canes only | (2) Moderate |
| (1) severe pain even at night | (1) absence of motion, slight deformation | (1) using crutches only | (1) Pronounced |
| (0) pronounced and constant | (0) ankylosis in a vicious position | (0) disability to walk | (0) Severe |

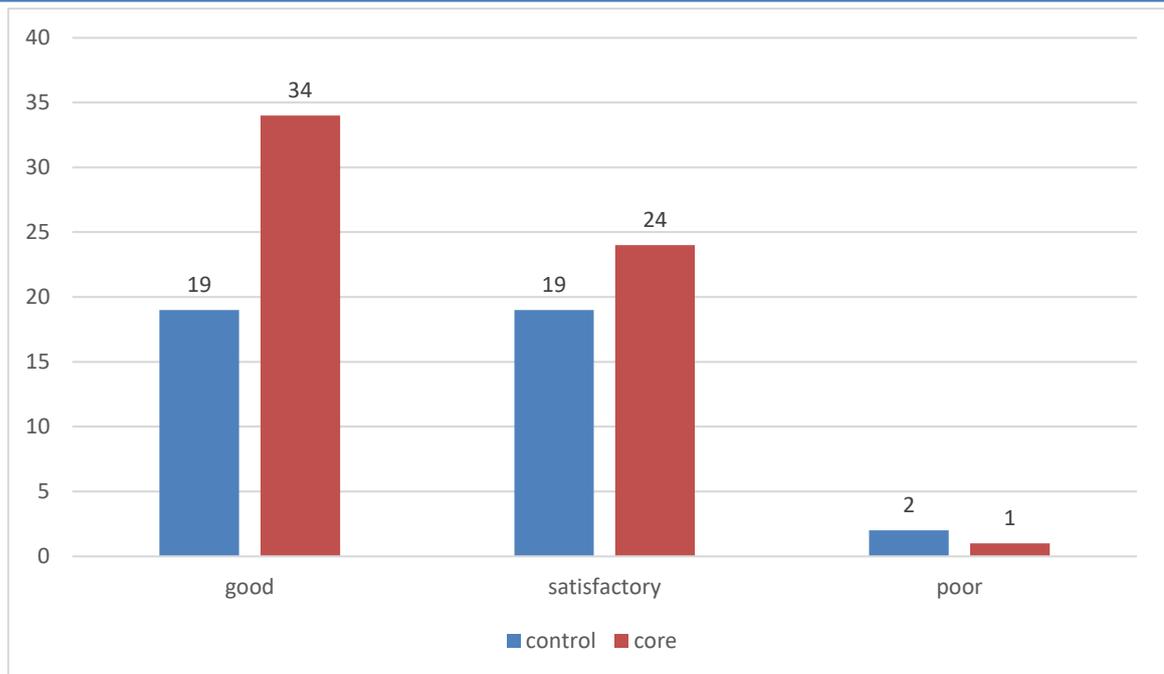
We evaluated the functional state of hip joint before surgery in 99 patients with AS. The patients of the third and fourth stages were divided into two groups: core and control.

The third stage included 50 patients: 30 patients in the core group, and 20 – in the control. The fourth stage - 49 patients: 29 patients in the core and 20 in the control group.

The results of surgical treatment. The evaluation of functional results was carried out after hip arthroplasty in AS using our developed computer Program for assessing the condition of patients after hip arthroplasty (No. DGU 2015 0452). This program allows to evaluate the condition of patients after THA.

Long-term outcomes were studied in 80 patients with AS after THA according to 4 main symptoms: pain, mobility, walking and lameness of the patient. In the medium follow-up period with long-term results from 1 to 6 years, the evaluation of the THA outcomes was carried out according to the U. Oberg scale; the core and control groups were compared.

These signs were divided into 6 categories and were evaluated at 11 and 12 points each. Evaluation of results can be carried out in two ways, in terms of absolute or relative indicators. We assessed the absolute values of the total and scored points of patients before and after THA (Diag.1).



Diag. 1. Evaluation of treatment outcomes

In the treatment of patients with AS, the use of cementless endoprosthesis allows to widely implement the method of hip arthroplasty. In cases of patients with AS associated with severe osteoporosis, protrusive coxitis and defects in the acetabulum walls, the operation of choice is THA using bone cement.

According to the results of the study, it was established that using THA in patients with AS, regardless of age, is the effective method of surgical treatment that eliminates pain and improves the patient's quality of life.

We also proposed the device which contributes for the early rehabilitation of patients, carried out in the postoperative period. It should be noted that this device of great importance for the recovery of the hip joint function. Besides, the utility model patent was developed and obtained (Device for developing motion in the hip joint FAP 2016 0077 dated June 17, 2016) (Fig. 2).

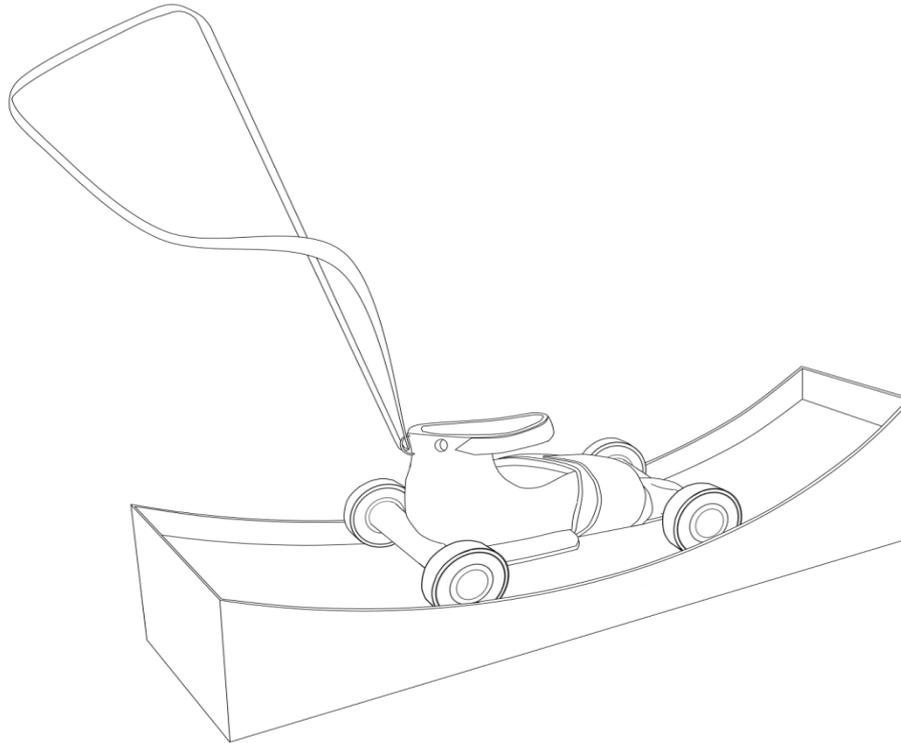


Fig. 2. Device for developing hip joint motion

The proposed device for developing hip joint motion differs from other prototypes by the fact that it consists of boot-like braces for both lower extremities. In the upper part of the braces it is equipped with fasteners installed on a plate and equipped with bearings. The device back has strap holders for the patients to control the range of motion and the load on the operated limb. The device is used as follows: the belt connected to the fixator is slowly pulled towards itself, moving the device along the rails with raised ends until pain is felt. Motion development is carried out from 4 to 20 manipulations daily. The device is easy to use and provides active and passive motion development in the hip joint. Besides, it allows to treat patients with hip joint diseases and to carry out early activation, as well as reduces the percentage of postoperative contracture and improves treatment outcomes in the postoperative period.

CONCLUSIONS

1. Hip joint dysfunctions depend on the intensity of clinical signs of the disease. AS of 3 and 4 stages lead to severe disability and is the indication for THA.

2. During the surgery, the device used to determine the depth of the acetabular component, facilitates the performance of the surgical intervention and reduces postoperative complications.

3. Surgical intervention depends on the disease stage, which helps to accelerate the recovery of the hip joint and affected limb functions. The use of the Device for the motion development in the hip joint worked out by us helps to reduce the recovery period from 5.2 ± 0.15 and 9.1 ± 0.5 days, respectively ($p < 0.001$).

4. The device for the hip joint development is convenient to use and provides active and passive motion development in the hip joint. Besides, it allows to treat patients with hip joints diseases and to carry out early activation of the patient.

5. Evaluation of long-term outcomes of treatment showed that indicators of good results in the core group were significantly higher compared to the control group. Poor results were obtained in patients of the core and control groups.

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