



CASUISTIC PAPER

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A comparative analysis of the rehabilitation course of two patients after the implantation of an artificial hip joint

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Abstract

Introduction. Endoprosthetics is the most effective method of returning to a normal way of life without pain. The key element is the post-operative rehabilitation program where a patient has to comply with certain rules and principles. The rehabilitation also includes the family of the patient. Each person, after any surgery requires an individual approach, and no patient can be commonly treated.

Aim. The aim of the article is to compare the effects of an early rehabilitation after the implantation of an artificial hip joint in two patient cases.

Description of the cases. This research was conducted at Bodden-Klinken GmbH. An individual case study was used, based on an example of two patients at the age of 59 who had implantation of an artificial hip joint. The carried out rehabilitation of the patients was conducted without any disruptions. Patients were able to freely walk on crutches nine days after the procedure.

Conclusions. In the cases analyzed, the rehabilitation course was described until the ninth day after implantation of an artificial hip joint. High results in terms of patient rehabilitation were achieved. Furthermore, in order to continue their therapy, they were referred to the sanatorium.

Keywords. artificial hip joint, rehabilitation, post-surgical rehabilitation

Introduction

Femurs are very thick and at the same time, highly strong bones. In order to break it, as far as young and healthy persons are concerned, an extremely high force is required, which mostly occurs in terms of traffic accidents. However, it is significant that the majority of people who suffer from a broken femur are not young or healthy. A wide range of pathologies which determine a reduced durability of bones can be distin-

guished. Among others, those include: osteoporosis, tumors, and bone disorders that are connected with renal failure.¹

The treatment of such fractures should begin as quickly as possible. However, fracture of a hip bone does not result in detrimental life changes due to the fact that the fractures are surrounded with a thick layer of muscle and the risk of critical organ damage as well as the risk of open fracture is at a really low level.¹⁻⁴

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An effective and at the same time, the most widely used method of treatment of such fractures is endoprosthetics of the hip joint which refers to the operational change of the damaged femoral neck and end, as well as in some cases – the acetabulum, into ceramic-metal or metal-plastic prosthesis. The reason behind the popularity of this method is strictly connected with the fact that fusing of bone takes significantly more time and during such time, a clot can occur resulting in patient mortality. On the contrary, after endoprosthetics, a patient is able to stand up after a few days and after a total healing of the wound, he or she can entirely walk on his or her own. The healing effects occur significantly faster. What is more, part of the femoral neck located closer to the hip as well as the femoral neck are irrigated from the side of the femoral diaphysis. Therefore, if a fracture takes place, the blood vessels are extinguished and, as a result of that, a neck and end remain without blood supply. Necrosis occurs and the acceleration is no longer possible. Among the most significant complications after this type of operation may include: anemia, losing a prosthesis, infection as well as thromboembolic complications.⁵ Taking this into consideration, heparin is injected under the stomach skin of each patient. Nonetheless, the rehabilitation process pays significant attention to putting a patient on its feet and beginning the process of walking. Mostly, a rehabilitant, whose work and effort contribute directly to saving life of suffering people, aids in rehabilitation. For an elderly person, each downfall is potentially life-threatening. Therefore, taking care of the environment, prevention, as well as contracting the described fractures are of great importance.⁶⁻⁸

However, there are certain factors which considerably increase the risk of hip fracture:

- Osteoporosis,
- Benign and malicious bone cancers,
- Using immunosuppressive treatment (such as steroid medication),
- Innate fragility of bones and brittleness of bones,
- Hormonal changes,
- Improper eating (especially calcium and protein deficiencies),
- Too low level of physical activity.⁹⁻¹²

At the initial phase of treatment, after the procedure, limited physical activity is recommended in order not to overtire the hip as well as the operated leg. If using operational treatment was not possible, for example due to a bad health condition, then an additional derotational leg plaster is used. Due to a high risk of thrombosis, people suffering from hip fracture are administrated anticoagulants. Patients are also provided with painkillers. A part of injured patients require blood transfusion.¹³⁻¹⁵

Before starting a surgical procedure, an overall internal assessment and additional examinations should be conducted. The surgical treatment mostly includes:

- Connection of broken bones parts with the use of special screws, nails and angular boards,
- Substitution of the broken part of bone with an artificial element – endoprosthesis which can be partial or total (total hip replacement).¹⁶

In majority of cases, the prosthesis of hip joint includes the following elements: acetabulum (globular element attached to pelvis one), cylinder (“bearing” of the moving end), end (ball located on the mandrel) and mandrel (a part of prosthesis located in the hip bone).

Among prosthesis, one may distinguish: unicondylar, complete (cemented and uncemented). An unicondylar endoprosthesis is of an old type, however it is still widely used. A complete endoprosthesis can be divided into cemented and uncemented. Sometimes, especially during a revision surgery, during a change of an old endoprosthesis into new one, hybrid solutions are used (one part is cemented whereas the other one is not).

The cemented endoprosthesis is located in the bone using an acrylic bone cement, whereas the uncemented endoprosthesis is stabilized at the bone stock mechanically.

Mostly, the acetabulum of the diameter of 50 to 54 mm are integrated. However, extreme sizes such as 38 mm and 72 mm occurs. Similar situation can be observed in reference to mandrels which occur at the variety of sizes (the set includes 7–10 sizes). At the pre-operational planning stage, exact measurements are made on radiograms, using dedicated templates including the bio-mechanical conditions that occur after the procedure.¹⁷

The aim of the operation is to achieve stability of the end of endoprosthesis in an acetabulum, to reproduce the axis of rotation of joint in a physiological point, to sustain the tension of the periarticular tissues, to situate a hip bone in proper distance with reference to pelvis (so-called offset) and to create conditions that enable a proper range of motion.

In case of surgeries, the post-isometric relaxation of the muscle within a pelvis is used (analgesic activity increasing the range of joint motion). Functional massage is used, such as the massage of gluteus medius muscle, tensor fasciae latae muscle, quadriceps femoris muscle, adductor magnus muscle. The main assumption of this action is to decrease pain and to retain the total passive mobility of hip joint at any direction.¹⁸

The aim of the article is the comparative analysis of the effects of the early rehabilitation after the procedure of injection of an artificial hip joint, focusing on two patients.

Description of the cases

The research was conducted at Bodden-Kliniken GmbH. The method of an individual case study was used. The participants were two patients at the age of 59 who had

injected an implant at the same day. The physical operations were conducted in accordance to the standards of the Clinics, what will be further described including the conducted procedures.

Both patients were diagnosed with degenerative hip disease. After no symptomatic treatment, patients were referred for surgery. Patient no. 1 underwent surgery - implantation of the endoprosthesis of the right hip. Additional blood and urine tests were performed. The operation was performed without complications. During the stay, breathing exercises were carried out, the lower limb was massaged, the correct posture was learned while walking on crutches, and the patient and his family were informed how to proceed after leaving the hospital. After the procedure pain medications were administered at the patient's request such as painkillers by intravenous injection. Two blood units "AB" Rh (+) were transfused to the patient. Blood was absorbed without negative reactions from the body. During the stay in the ward, the patient also had a X-ray of the hip joint and gastroscopy performed. Surgery for patient no. 2 was performed - cementless prosthesis of the right hip. Additional blood and urine tests were performed. The operation was performed without complications. After the procedure, pain medications were administered at the patient's request, such as: painkillers in intravenous injection.

The characteristics of the patients are presented in the Table 1.

Effects of post-hospital rehabilitation

Since the first post-operational day, the physiotherapist began the work with each patient individually, in accordance to the physiotherapy standards established in the Implantology Center Bodden – Kliniken GmbH. In both cases of the two patients postoperative observation was performed in which every two hours the pulse and heart rate were checked, the general condition of the patient, the level of pain, blood supply, limb staining, feeling.

During the first visit of the therapist, the instructions concerning what movements and in what scope can be done by a patient were given. The next stage included a mobilization of patients into a sitting position, taking the necessary safety precautions. Patient no. 1 did not find it difficult and completed the task almost on his own. On the contrary, Patient no. 2 required a considerable help of the physiotherapist, suffering from nausea and vertigo. The next stage included a preparation of medical supplies for patients - crutches with an anatomic handle providing comfort for both of them. Both patients managed to complete this task in an excellent way and each one, in turn, began to learn the three-point gait. The first steps were took at the Patient's room.

Table. 1. Characteristics of the patients

Specification	Patient no. 1	Patient no. 2
Age	59 y/o	59 y/o
Professional activity	Professionally active, willing to return to work	Due to a persistent pain – professionally inactive and rather does not declare return to work
Profession	Restaurant worker	Real estate agent
Type of works	Constantly moving	Mostly sitting behind his desk or in the car
Body parameters	Weight:78 kg, Height: 182 cm.	Weight: 117 kg, Height: 179 cm
Sporting activity	Biking, swimming	Lack of sporting activity (walking with wife or dog alternatively)
Hip joint degeneration (family)	No problems connected with hip or knee joint degeneration observed in the family	No problems connected with hip or knee joint degeneration observed in the family
Moving before surgery	Moving in the last hours, however, due to increasing degeneration of hip joint experienced a persistent pain. While sitting at the scale from 1 to 10, it often amounted to 8, however it decreased to 4 during movement. However, it was too persistent that it required the use of pharmacology.	Moving in the last hours, however often using crutches and large amounts of painkillers. While sitting and walking the high discomfort was experienced which at the scale from 1 to 10 amounted to 9.
Mobility of the joint	Despite a persistent pain, the scope of mobility in the joint did not change significantly due to the fact that the patient did not observe any changes in this scope.	The scope of mobility of the patient decreased by the internal rotation of the limb, lifting the limb during laying as well as during abduction.
Execution of the surgery	The patient was admitted to the clinic in order to have an implantation of the right hip point made in general anesthesia in January 2018	The patient was admitted to the clinic in order to have an implantation of the right hip point made in general anesthesia in January 2018

The next stage included kinesis therapy which took place at the bed of the Patient – laying on his back. Those were breathing and circulatory exercises. Activation of the healthy limb in first place, including abduction and bending in hip and knee joint, was a crucial element. This exercise was performed by both patients without any problems. However, as far as the Patient no. 2 is concerned, it elicited iliopsoas muscle spasm. Then, both patients performed the isometric and isotonic exercises of both limbs as well as gluteus muscles. The next stage concerned an alternate work with limbs by way of long lever of straightening the knee joint in order to activate the thigh muscle. Those two exercises were performed excellent by both of the patients. However, during abduction (the active supporting exercises) as well as bending in the hip joint up to 90 degrees of the operated limb, the Patient no. 1 was the leader. On the contrary, the Patient no. 2 suffered from muscle spasms and pains of the hip.

In order to improve the efficiency of hip, the decision regarding conduction of rehabilitation splint (*Continuous Passive Motion* - CPM) - twice a day was made, trying to achieve a flexion in the knee and hip joints up to 90 degrees, obviously not from the beginning. Then, both patients were informed about the necessity of laying on their back and lack of possibility of making a flexion in their hip larger than 90 degrees. They can go to the toilet with help of nurses or therapist and sit on the bed on their own, of course from the operated side. After a few hours it turned out, that the Patient no. 2 is unable to conduct this activity on this own.

Two days after the operation, both patients seemed to be in good shape. At the beginning, the exercises conducted on the previous day were repeated, however the number of repetitions and intensity increased. The overweight patient suffered from higher pains during the mobilization and the exercise concerning bending and abduction in hip. Rehabilitation splint which was mentioned before was activated. The bend allowed only for 55 degrees. The procedure lasted 30 minutes. It can be added that the same activity was conducted after six hours and bending in knees amounted to 75 degrees. After conduction of the exercises, both patients began an individual mobilization in order to sit on the bed. Then, without any significant problems, using two elbow crutches they stood up and began to learn a proper three-point gait. Better results were achieved by the Patient no. 1 who had a normal weight.

At the third, fourth and fifth day after the operation, the amount and intensity of exercises was extended. Rehabilitation splint used in case of the Patient no. 2 showed 80 degrees after fifth day of the rehabilitation. What is more, the patient experienced a smaller discomfort. Both patients continued the gait training concerning previously provided rules. However, the distances were

getting longer. Nonetheless, the Patient no. 2 suffered from larger problems than before since his heart rate and blood pressure raised.

On the sixth day after the operation the same exercises as on the fifth day were conducted. The additional element constituted the two-point gait learning, alternate and similar to the physiological gait. Patient no. 1 completed the exercise in an excellent way, however, the Patient no. 2 with his obesity and different lifestyle had a problem with a ballast received by his newly-embed joint. Therefore, he remained at the three-point cycle of gain. However, the rehabilitation splint work showed 90 degrees of bending both knee and hip joints what took place without any considerable problems.

On the eighth day both patients without large problems, were able to complete the total set of exercises and Patient no. 2 began and successfully finished learning of two-point gait. The next exercise included learning on climbing stairs with the help of handrail and one crutch. Both patients efficiently managed to climb 27 steps of stairs downwards and upwards. However, the Patient no. 2 suffered from lack of oxygen (he suffered from a breathlessness probably caused by an increase of air pressure). The next exercise was completed only by the patient no. 1. It was connected with climbing stairs using two crutches. Patient no. 2 argued that he is not able to maintain such balance.

On the ninth day, both patients were discharged from the hospital with given instructions. At the same day, they were admitted to the orthopedic sanatorium for three weeks in order to continue the more advanced therapy.

Discussion

Hip is one of the largest joints in human organism, which join pelvis together with femur. It constitutes of acetabulum of pelvis and end of femur. The entire joint is surrounded with the strong and thick articular capsule, enhanced with ligament apparatus. Endoprosthetics (hip replacement) is currently a widely accepted standard of treatment in case of joint destruction with an annual systematic increase of the number of conducted operations.

The progress of the current medicine provides novel and better opportunities concerning restoring of fitness of people suffering from osteoarthritis who previously were condemned to life with strong pain. After the operation of implantation of an endoprosthesis, the early introduction of rehabilitation activities is recommended in order to recover patient's proper motion range as well as the potential full fitness as a result of the decrease of pain. On the first day after the operation, the patient is prepared to walk on his or her own.

The source literature includes certain recommendations regarding rehabilitation for the patients after the

implantation of an artificial hip joint which comprises a wide scope of physical, kinesiotherapeutic procedures, planning of the treatment process including a variety of stages. However, majority of authors is focused on the aspect of kinesiotherapy.¹⁹⁻²¹

On the basis of the research conducted by M.S. Krastanov, E.M. Iliev i E.V. Danelin, it was proven that using a long-term kinesiotherapy program, with reference to the treatment of the patients after the implantation of an artificial hip joint, adjusted to the individual conditions of health care, can contribute to a faster recovery after an operation, especially in terms of electro-stimulation.²²

The aim of the research conducted by J. Stanek et.al. was to rate the subject of hip arthroplasty and to assess the mobility of patients after hip replacement. The tests were carried out among patients after total hip replacement. The respondents were a group of 120 people, in which there were 76 women (63.3%) and 44 men (36.7%) using the specialist Rehabilitation Clinic of the Karłowice Medical Center "KAR-MED" in Wrocław from February to December 2013. Patients who underwent endoprosthesis were significantly improved in functional status and reduced pain. This favorable trend was found in all areas of life included in the research carried out by the authors of the work. The implantation of the endoprosthesis caused a statistically significant reduction in the number of patients with reduced walking efficiency (by 28.4%), as well as those experiencing hip, buttock and thigh pain (by 20.9%). After the surgery the percentage of patients who received rehabilitation increased from 57.5% to 95%. The percentage of patients with very severe pain decreased from 19.2% to 0.8%, and with severe pain from 47.5% to 8.3%. As a result arthroplasty, the degree of difficulty in performing all the analyzed activities significantly decreased ($p < 0.0001$). Before the surgery, 21.7% of the subjects underwent rehabilitation treatment, while 75.9% followed the procedure for rehabilitation.²³

When analyzing the data of the American health insurance system, it can be concluded that the number of total arthroplasty increases with age and above 75-79 years of age significantly decreases and more often affects women. In the own study, the group of women was also more numerous and accounted for 63% of the respondents, and the average age was 69 years.²⁴

These results were confirmed in the Borowicz study.²⁵ After the procedure pain became much less annoying. According to Mańczak et al. the main assumptions of post-operative rehabilitation are to reduce pain, exudation and inflammation, achieve the greatest possible range of motion and regain muscular control as quickly as possible.²⁶ According to Pozowski, the most common cause of hip replacement is degeneration of articular cartilage and underlying subchondral bone layer they are a degenerative disease.²⁷

Conclusions

This paper describes the rehabilitation of two patients who differ among themselves primarily lifestyle (active and passive), which had impact on body weight subjects (normal body weight and obesity). Despite the improvement observed in both cases, patient No. 2 had more difficulties and worse results.

As far as the analyzed case studies are concerned, the process of rehabilitation until the ninth day after the completion of the operation of implantation of an artificial hip was described. Both patients achieved similar results in terms of improvement.

The rehabilitation took place without any major problems. What is more, no complications were observed. In order to continue the specialist therapy, both patients were admitted to sanatorium.

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