

REPLACEMENT OF HIP JOINT – PERIOPERATIVE PROCEEDINGS

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Abstract: Developing industry, technology and mechanization as well as the era of fast transport and communication development that increase the number of traumas and motor system conditions, all lead to the development of orthopaedics. One of the achievements is the increasingly improving endoprosthesis – an implant that replaces the damaged joint surfaces, and, thereby, allows the patient to move effortlessly on their own.

Since the 1950s, there has been a steady development of the hip joint arthroplasty; the shapes of the implants, the clamping systems and materials of which they are made, change and get modified.

The hip joint is one of the most important joints in the human body. It is a joint that belongs to the connections of the lower limb girdle. It is formed by the acetabulum of the pelvis and the head of the femur.

Advanced changes of the joint that lead to stiffening and limiting the range of motion on the joint, and to fracture are all indications for the hip joint replacement.

In order to diagnose correctly, the physician must perform a medical examination of the patient, first an interview, and then a physical examination.

These examinations should be followed by radiological, biochemical and examinations.

The choice of treatment method depends on the age, general condition of the patient and the type of fracture.

The conservative method relies on the placement of a direct skeletal traction with a Kirschner wire and placement of the limb on the splint with an appropriate weight adjustment. This form of treatment takes from 6 to 10 weeks, until the bone is fixed.

One of the surgical methods is arthroplasty. It is a method used mostly in elderly patients.

Preparation of the patient for the endoprosthesis placement surgery consists of both the physical and the psychological part.

Rehabilitation of the patient in the early post-operational period improves blood circulation in the lower limbs, reduces the risk of clots, bedsores and allows for strengthening of the muscles as well as enhances the functionality of the operated hip joint.

The moment the patient is discharged after the surgery, the role of the nurse for the patient and his family changes from the caring and therapeutic to educational. The nurse informs the patient and his family that if they follow all the recommendations, they will avoid the post-surgical complications and regain their full functionality fast.

Key words: arthroplasty, preparation for surgery, rehabilitation.

Introduction

The fact that, in recent years, more and more elderly people, but not only them, suffer from motor organs diseases, has become a serious medical problem. In January 2000 in Geneva, to emphasise the scope of the problem, the WHO called the decade 2000-1010 “The decade of bones and joints” [1].

Constantly developing industry, technology and mechanization as well as the era of fast transport and communication development increase the number of traumas and motor organs diseases, create the necessity for the development of orthopaedic techniques.

One of the achievements is the increasingly improving endoprosthesis – an implant that replaces the damaged joint surfaces, and, thereby, allows the patient to move effortlessly on their own [2, 3].

Endoprosthesis of the hip joint is also an alternative for elderly people. It allows for the treatment of traumas and degenerative diseases of the motor organs, and fast recovery after the surgery without the need to stay in bed for a long

period of time, which is of great importance for the elderly, when it comes to full recovery or even avoiding premature death [2, 3].

Co-existing diseases appearing at this age very often decrease body’s physiological resilience to trauma. An accident breaks their everyday routine, long immobilization causes bedsores and respiratory system complications.

The necessity to place a urinary catheter for a long period of time frequently causes urinary tract infections.

Long-term immobilization leads to the occurrence of thromboembolic complications, cerebral circulation disorders (strokes and embolisms), which in turn, result in death [2, 3].

Successful surgery, proper care, rehabilitation and following the doctor’s guidelines offer a great chance of full recovery [1, 4].

Hip joint anatomy

The hip joint is one of the most important joints in the human body. It is a joint that belongs to the connections of the lower limb girdle. It connects the pelvis with the lower

limb. It is formed by the acetabulum of the pelvis and the head of the femur.

The articular surface of the acetabulum forms a wide, partly opened ring that encompasses a fossa, called acetabular fossa [5].

The surface of the head of the femur and the acetabulum are covered by articular cartilage. It is strong and smooth, which allows for the movement of the the articular surfaces against each other in the joint without damaging them [5].

In the joint cavity there is a ligament of the femur head with blood vessels inside. The blood that enters the hip joint comes from two sources:

- medial and lateral femoral artery;
- artery of the femoral head.

The blood supply of the hip joint is of great clinical importance. The damage of the artery in the ligament of the femoral head leads to the femoral head necrosis, and, consequently, to the complete deterioration of the femoral head, which collapses and prevents the movement in the joint, which results in permanent disability.

Hip joint biomechanics

Hip joint is a ball-and-socket multiaxial joint. The movements in the joint are performed on three main axes:

- transverse axis: flexion and extension of the thigh, and when the limbs are stabilized – lifting and lowering of the pelvis;
- sagittal axis: abduction and adduction of the limb;
- longitudinal axis: lateral and medial rotation, and with stabilized thighs – rotation of the pelvis.

Additionally, the hip joint allows for a compound movement – circumduction, which is a combination of flexion, extension, abduction and adduction [5, 6].

Indications for hip joint replacement

Advanced changes of the joint that lead to stiffening and limiting the range of motion on the joint as well as to fractures in the proximal femur region are an indication for the hip joint replacement [7, 8].

Arthrosis of the hip joint (coxarthrosis) – is a degenerative disease of the hip joints, which involves progressive degeneration of the articular cartilage.

In the course of this disease, the bone loses its protection, the cartilage layer. The surface of the bones that form the joint become rough and on their edges appear exostoses. It leads to pain, stiffness and limitation of the hip joint mobility, and, as a result, limitation of walking ability.

It usually lasts for many years and the symptoms increase gradually with differing speed. It can affect one or both of the hip joints [6, 8].

Rheumatoid Arthritis AR – is a multisystemic disorder characterised by a chronic autoimmune inflammation process. It is the most common disorder of the connective tissue.

It is characterised by a non-specific joint inflammation, changes in many organs, which lead to disability and premature death [6, 8].

In the course of AR, orthopaedic methods of treatment should be introduced early enough to manage the outbreak of the disease [6, 8].

Ankylosing spondylitis AS – it is an autoimmune, chronic, progressing inflammatory disease of the connective tissue with genetic predisposition. It affects the joints and intervertebral and sacroiliac ligaments, leading to their gradual stiffening [6, 8, 9].

Systemic lupus erythematosus – it is an autoimmune disease that is related to various autoimmune system disorders, that leads to the inflammation of numerous tissues, organs and joints [6, 8, 9].

Gout – it is a variety of inflammatory arthritis, which appears due to elevated levels of uric acid in the blood, the so-called hyperuricemia, which results from metabolic disorders.

The area of the affected joint is very painful, overly warm, red and swollen. It develops into chronic polyarthritis [8, 9].

Osteoporosis it is a disease characterised by bone loss, the so-called “light bones”, and changes in the bone tissue, that leads to higher risk of bone fracture [7, 8].

It progresses over a long period of time with no symptoms. It is often referred to as “the quiet bone thief” [8].

It affects mostly women over 60 years of age, because the fastest bone loss occurs in women in the first few years after menopause [8].

Femoral neck fracture

Femoral neck fracture is a partial or complete fracture of the femur in the area of the hip joint, which is called the femur neck. It usually occurs in elderly people, predominantly women [?, 6, 10].

When the fracture occurs on a bone, which strength has decreased due to prior changes (osteoporosis, inflammatory diseases, metastatic tumors), the fracture is called a pathological fracture [6, 10].

The causes of femoral neck fractures

The causes of femoral neck fractures depend on age, gender, and coexisting diseases.

- trauma – usually a minor fall (in elderly);
- spontaneous fracture of the pathologically transformed bones;
- communication accident (mostly in young people) [6–8].

With age comes deterioration of the bone mass, muscle weakening, ongoing atherosclerosis, decrease in mobility. Therefore, a minor trauma in an elderly person is enough to fracture the neck of the femur [1, 6, 8].

Women have smaller and thinner bones, the drop of estrogen level during menopause and low calcium diet contribute to more frequent osteoporosis and bone weakening. Hence, women experience femoral neck fractures more often [8, 11].

One of the causes of femoral neck fractures are autoimmune diseases, that lead to joint inflammation, which results in their degeneration, damage, and, consequently, a fracture [8–10].

Young people are the ones, who use different means of transport most often, therefore, they experience femoral neck fractures during communication accidents. It is often that practising professional sports lead to degenerative changes in the bones, which cause femoral neck fractures [7, 8, 11].

Femoral neck fractures classification

Femoral neck fractures can be divided according to: the position of the fracture fissure and the mechanism of action.

Blood supply to the proximal fragment depends on the position of the fracture fissure. On this basis, the chances of spontaneous bone union in the conservative method of treatment are assessed or an accurate surgical method is chosen [6, 10–12].

- According to the position of the fracture fissure
 1. subcapital;
 2. transcervical;
 3. basicervical;
- According to the mechanism of action
 1. abduction fracture – stable with no displacement;
 2. adduction fracture – displacement of the segment of the femur [11, 12].

Femoral neck fracture symptoms

The symptoms depend on whether there is a displacement or on the mechanism of the trauma. They include:

- **Strong pain in the hip joint area** that escalates when patient tries to move. The cause of it is the damage of the highly innervated periosteum by the friction of the segments, and an increasing haematoma that causes circulation disorders and compression of nerves.

- **Limb mobility limitation or inability to stand and walk**, due to the segments misplacement.
- **Pathological position of the lower limb, during flexion, abduction and external rotation** – external rotation of the limb is a result of the domination of the external rotators muscles that show no resistance that is placed by the iliofemoral ligament.
- Shortening of the limb, due to the lateral displacement of bone fragments.
- Ecchymoses and aedema in the hip joint area appear due to the damage of the subdermal vessels and blood exudation into tissues.
- Deformation of the hip joint area as a result of an unnatural limb placement in the hip joint due to bone fragments displacement [6, 10–12].

Diagnostic methods for the detection of femoral neck fracture

Diagnostic methods for the detection of femoral neck fracture include the interview and physical examination, that consists of: observation, palpation, percussion and auscultation.

The examinations should be followed by radiological, biochemical and other exams, depending on the symptoms and condition of the patient [10, 13].

Interview

A carefully obtained history is crucial in the detection of femoral neck fracture. The interview should be conducted not only with the patient, but also with their family, especially if trauma affects elderly people, who often have limited mobility or memory deficits.

The history should include the age of the patient, their occupation, present general and specific symptoms. They should provide detailed information on the circumstances and the mechanism of the trauma. The clinician should ask about the position of the body at the moment of trauma and try to establish the scope and extent of the operating forces, and whether the trauma was caused by a fall, a slip or a communication accident.

It is important to collect information about the pain and dysfunction of the hip joint. The interview should also include the disease history and the patient's way of moving before the trauma.

Detailed information about the coexisting diseases, the drugs intake is crucial in determining the therapeutic management, and in the case of surgical treatment, choosing the operating and anaesthesia methods [13, 14].

Physical examination

It includes the assessment of the hip joint position and the active and passive range of motion in the hip joints. The joints should be palpably examined for tenderness, swelling,

deformities, which can suggest the cause of bone weakening and fractures. Ecchymoses in the iliac fossa suggest trauma as the cause of the fracture. The level of obliteration of the joint line and the position of lower limbs is examined in the horizontal position [13,14].

The motion of other joints in the limb, its blood circulation and the feeling, especially around the tibia and the foot are also examined. The presence of vascular changes especially in the vascular system, is of significant importance when considering surgical methods of treatment of the femoral neck fracture [11–13].

Radiological examinations

They are the conclusive diagnostic procedures related to the femoral neck fracture. They include:

- X-ray of the pelvis with both hip joints in the frontal-back position and in the axial position of the injured hip, and, in selected cases, of the lower back and the knee of the affected side [10,12].
- Magnetic Resonance Imaging (MRI) enables the detection of femoral neck fracture without dislocations in elderly people and aseptic necrosis of the femoral head [10].
- Computer Tomography (CT) allows for complete assessment of the iliac acetabulum and better visibility of the intra-articular bone fragments. It also makes the planning of the re-constructive procedures easier [10,12].

Treatment methods of the femoral neck fractures

The choice of treatment method depends on the age, general condition of the patient and the type of fracture.

Conservative method

The conservative method relies on the placement of a direct skeletal traction with a Kirschner wire and placement of the limb on the splint with an appropriate weight adjustment. This form of treatment takes from 6 to 10 weeks, until the bone is fixed [6,10–12].

Indications for the conservative method of treatment include:

- wedge fracture in young people;
- partially stable wedge fracture, with general high strain on the patient and high operational risk;
- clear contraindications for any kind of surgical treatment;
- lack of patient's consent for surgical treatment [11,12].

Surgical method

- **Intramedullary fixation with Gamma nail or Ender nails – Dynamic Hip Screw method)** is used with transcervical and basicervical fractures. In this procedure, the head and neck are held together by a plate and four or five cortical screws [10,12].
- **Arthroplasty** – it is a surgical method used in subcapital fractures and coxarthrosis. In this procedure, the head of the femur is removed and replaced with a metal prosthesis [1,12,15].

Arthroplasty can be:

- **total:** acetabulum and the head are replaced with artificial elements. The prosthesis comprises of a stem, acetabulum and head [6,11,15].
- **partial:** only the femoral head is resected and replaced with a prosthesis. The prosthesis comprises of a stem and acetabulum. It is used in patients older than 70, mainly with subcapital femoral neck fractures.

Depending on the type of bonding with the bone surface, endoprostheses can be divided into:

- **cemented** – attached to the bone with bone glue called cement. It includes polyethylene acetabulum, metal stem and metal or ceramic head. It is used in elderly patients due to fast mobilisation of the patients after surgery [3,11].
- **uncemented** – acetabulum is press-fitted or screwed to the bone and the stem is fixed to the femoral stem by means of impaction. Both elements of the endoprosthesis are metal with a rough surface, which, in time, allows for the endoprosthesis to grow into the bone [3,11].
- **hybrid** – one element of the endoprosthesis (the stem) is attached with cement, and the other one (the acetabulum) with the cementless technique [3,4,11].

The materials more and more often used for the surface of the acetabulum are ceramics and metal, as they don't provoke inflammatory reaction, which prevents the loosening of the prosthesis [3,4,11].

Due to fast loosening of the prostheses in young people with high levels of physical fitness, in the 1990s, an Englishman, dr Derek Mc Minn used a new method – Birmingham Head Resurfacing (BHR) and Birmingham Mid Head Resection (BMHR). It is perceived as the best method in the world, used in young patients, whose femoral head is not fully destroyed. It is a way less invasive method than arthroplasty [4].

The future of battling diseases affecting joints is tissue engineering. With the help of technology it might be possi-

ble to grow and transplant whole joints in the future. However, before that happens, the only and effective method of damaged hip joint replacement is arthroplasty [4, 5].

Preparation of the patient for the hip joint endoprosthesis placement surgery

Preparation of the patient for the endoprosthesis placement surgery consists of both the physical and the psychological part.

Thorough preparation ensures the safety of the patient and success of the surgery as well as minimization of the complications risk [16–18].

Preparation for the surgery

Psychological preparation

Anxiety is very common in patients before surgical operation. It can be observed that elderly people fear of disability and death. Therefore, it is very important to have a kind and friendly conversation with the patient to explain the gist of the surgery and to dispel any doubts concerning the treatment process and the surgery.

The patients that acquire the information they need feel less insecure and anxious and, in result, recover and gain their mobility back faster [16–18].

The role of the physician is:

- to inform the patient about the specifics of the surgery;
- to inform the patient and the family about the preparation for the surgery, when to begin;
- to inform the patient about the possible complications after the surgery and how to behave to avoid them;
- to explain to the patient how important the rehabilitation before and after the surgery is to return to full mobility [11, 13].

The role of the nurse is:

- to make the patient familiar with the ward topography and the therapeutic team;
- to explain to the patient the necessity, the method and the date of the pre-operational examinations
- to inform the patient about the non-pharmacological means of pain management after the surgery;
- to enable the contact with a psychologist;
- to enable the contact with patients, who have gone through a successful arthroplasty;
- to speak with the patient's family to make them aware that the patient will need their kindness and psychological support, and after the return home, their care as well;
- to ensure care for the solitary patients through social care institutions [10, 15, 16].

Physical preparation

It is more thorough, if the patient is operated according to schedule, as it lasts longer. It usually begins three months before the surgery and it involves treatments and actions recommended by the physician, such as:

- exercise, in order to be in the best physical condition before surgery. Exercises to strengthen the upper parts of the body make the adjustment to use a walker and crutches after the surgery easier;
- reducing body mass – patients with the correct body mass should keep it, and the overweight patients should reduce the body mass to lessen the strain on the endoprosthesis after surgery;
- blood donation for autologous blood transfusion – the physician can recommend earlier blood donation, for later transfusion, if necessary;
- dental examination – a visit at the dentist and treatment of all dental diseases is recommended before surgery, as bacteria can cause infections in the implanted joint area;
- quitting smoking – preferably for a month before surgery, in order to decrease the risk of post-operational complications of the respiratory system;
- a general medical examination – before surgery, patients should be examined by the family doctor first, to establish the overall medical condition and to get vaccinated against Hepatitis B;
- examinations and laboratory tests – before surgery, the patient must undergo basic examinations, including: blood group and Rh factor determination, blood morphology, coagulation test, basic biochemical tests, general urine test, ECG, chest x-ray and other tests, depending on the co-existing diseases;
- proper nutrition – light diet, control of regular bowel movements, constipation prevention
- visit at the anaesthetic clinic for consultation – held by an anaesthesiologist. Its aim is to determine the condition of the patient and the co-existing diseases, analyse the laboratory and additional test results, assess anaesthetic risk, select the anaesthetic method, discuss the discontinuation of the use of drugs that can adversely affect the anaesthetic process, inform the patient about the pain management methods and obtain written consent of the patient for the surgery and anaesthesia [10, 19, 20].

Preparation of the patient just before the surgery

This preparation is done by a nurse and begins a day before and the day of the surgery. It includes psychological and physical preparation [10, 16, 17].

Psychological preparation:

- reducing anxiety level through kind and friendly conversation;
- informing the patient about all the performed procedures, such as: Foley catheter insertion in the bladder, peripheral venous cannulation, operating field preparation;
- assuring the patient of a continual nurse service;
- enabling the contact with the family before surgery;
- addressing spiritual needs at patient's request [10, 16, 17].

Physical preparation:

- informing the patient and ensuring that they do not eat or drink at least 6 – 8 hours before surgery;
- preparing the operational field, i.e. shaving the hair around the surgical incision;
- cleaning or helping to clean the patient's body, with particular focus on the operated area;
- reminding of removing or removing dentures;
- ensuring that the patient removes glasses, eye lenses, metal objects, ties long hair;
- changing patient's clothes to clean ones, preferably made from natural fibres;
- reminding women not to do make up or manicure and not to use any creams on the skin
- ensuring the patient urinates before surgery or inserting Foley catheter into the bladder;
- placing venflon cannula in the peripheral vein
- applying prophylactic antibiotic therapy, as requested by the physician;
- giving antithrombotic treatment, as requested by the physician;
- giving pre-medication assigned by the anaesthesiologist;
- taking the patient to the operating theatre [10, 16, 18].

Rehabilitation after surgery

Rehabilitation of the patient in the early post-operational period improves blood circulation in the lower limbs, reduces the risk of clots, bedsores and allows for strengthening of the muscles and enhances the functionality of the operated hip joint.

Systematic rehabilitation accelerates recovery and reduces pain. It is crucial that the patient regains the ability to care for themselves and is able to perform everyday activities as fast as possible [21, 22].

All the exercises should be carried out under the control of a physiotherapist.

Nurses play an important part in the rehabilitation process. Their presence, motivation and help with the exercises create a feeling of safety in the patient. They observe and test strain tolerance during exercises by measuring heart rate, breath and blood pressure [10, 19–21].

Educational role of the nurse in relation to the patient and their family

The moment the patient is discharged after the surgery, the role of the nurse changes from the caring and therapeutic to educational for the patient and his family, who will take care of them at home.

The nurse should give the patient and his family guidelines concerning the activities at home to prevent post-operative complications [10, 16, 22].

Conclusions

1. Hip arthritis is a problem that often affects elderly people as well as more and more people in productive age. The use of endoprosthesis is a way for them to return to normal life without pain and suffering.
2. Thorough preparation ensures the safety of the patient during surgery as well as the minimization of the complications risk.
3. Rehabilitation of the patient in the post-operational period is important, as it improves blood circulation in the lower limbs, reduces the risk of clots, bedsores and allows for strengthening of the muscles and enhances the functionality of the operated hip joint.
4. The educational role of the nurse is to make the patient and his family aware that if they follow all the recommendations, they will avoid the post-surgical complications and regain their full functionality fast.

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