Chapter

Arthroplasty as a Choice of Treatment in Hip Surgery

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Abstract

The hip joint bears the most load in the human body. For this reason, it carries the potential risk of degenerative arthritis in individuals with a functionally active lifestyle. The main goal in the treatment of degenerative arthritis is to achieve pain relief and create a hip joint range of motion close to normal. Even today, it is not possible to transform the hip joint, which has been degenerated due to several reasons and worn out due to the physiological properties of the cartilage structure, back to its natural state. Osteotomies, resection arthroplasties and hip arthrodeses, which are designed to compensate the load distribution affecting the hip and relieve the pain, are still employed methods. Total hip arthroplasty, on the other hand, is an alternative solution for the problem. Cemented, cementless and hybrid methods are widely used for this purpose in total hip arthroplasties. The purpose of hip prosthesis surgery is to shape the bone tips and to fill the fragments with various materials and keep these two structures as separate surfaces. Total hip arthroplasty consists of a femoral component placed in the medullas of the femur and an acetabular component placed in the acetabulum. In this article we will review the aims, causes, types and techniques of total hip arthroplasty.

Keywords: acetabulum, arthritis, femur, rehabilitation, total hip arthroplasty

1. Introduction

The hip joint bears the most load in the human body. Therefore, a functional lifestyle naturally carries a potential risk of degenerative arthritis. In a hip with degenerative arthritis, the main purpose of the treatment is to relieve the pain and create a hip joint range of motion close to normal. Even today, it is not possible to transform the hip joint, which has been degenerated due to several reasons and worn out due to the physiological properties of the cartilage structure, back to its natural state.

Osteotomies, resection arthroplasties and hip arthrodeses, which are designed to compensate the load distribution affecting the hip and relieve the pain, are still employed methods. Total hip arthroplasty (THA), on the other hand, is an alternative solution for the problem. Cemented, cementless and hybrid methods are widely used for this purpose in THAs.

Three different methods, including unipolar hemiarthroplasty, bipolar hemiarthroplasty and THA can be applied in femoral neck fractures, taking the patient's age, functional status before fracture and other accompanying diseases into consideration.

Total hip arthroplasty is considered as one of the most successful orthopedic surgery methods today [1]. Ninety percent of more than 1 million THAs per year worldwide are performed for treatment of osteoarthritis. The aging world population and increasing obesity indicate that the need for THA will increase [1].

A successful joint prosthetic surgery can be achieved with clinical, functional and radiological evaluations. However, it should be noted that many other factors, such as the material used, patient's age, surgical technique and fixation method affect the results. Although hip arthroplasty can be performed successfully in many patient groups including the young ones, it should be kept in mind that young patients in particular should avoid heavy physical activities in order to prevent early failure of the prosthesis [2]. The average prosthetic survival in hip arthroplasty is 10 to 15 years. Nevertheless, there are patients who do not have complaints even after 25 years [3].

2. Total hip arthroplasty

Total hip arthroplasty consists of a femoral component placed on the medulla of the femur medulla and a component placed in the acetabulum. The cementless type of the acetabular component consists of an outer cup attached to the acetabulum and a second cup which articulates with the femoral component.

The function of the femoral component is to replace the resected femoral head and neck. As the length of the femoral neck increases, the vertical height and the medial stem-head distance also increase. In routine practice, the neck used is 8–12 mm long. The relationship between the femoral neck and implant is established based on anteversion or retroversion on the coronal plan. The vertical height of the femoral neck is measured starting from the lesser trochanter. Since the depth at which the prosthesis is placed in the femoral metaphysis to adjust the height of the vertebra is definite, the level of osteotomy is not interfered. Instead, the neck length should be adjusted.

The distance between the center of the femoral head and the stem is the medial offset distance. A wider collodiaphyseal angle shortens the moment arm of the abductors and increases limping. If this angle is narrow, the load on the stem increases and causes loosening or breakage. The vertical height of the rotation center decreases in varus hips. Accordingly, the medial offset is relatively high. The height of the greater trochanter is not an accurate indicator for the center of the head. The vertical height and medial offset in excessively varus-valgus hips are difficult to restore. Therefore, the leg length and vertical height are corrected to avoid the possibility of facing a lower extremity length discrepancy and have a biomechanically stable hip in the postoperative period [4].

Anteversion of the femoral neck is important in ensuring stability. A retroverted neck causes posterior dislocations whereas anteverted neck causes anterior dislocations. For rotational stability, the proximal part of the femoral component should fill the metaphyseal cavity completely.

The components are designed either for cemented or cementless implantations.

2.1 Cemented acetabular components

The acetabular component is thickly coated with, preferably with a layer of 6–8 mm, high-density polyethylene [5]. Stability is increased by filling cement into the vertical and horizontal grooves. Protrusions of 3-mm-high are used to increase the stability between the prosthesis and cement [5].

There are a number of factors to consider when placing the cemented acetabular components. When the acetabular component is inserted, it should maintain the normal anatomical position at 45° of inclination and 15° of anteversion. The outer surface of the acetabular component should be wrapped with at least a cement layer of 2–5 mm [6]. The boundaries of the acetabular component should be within the boundaries of the bone acetabulum.

2.2 Cemented femoral components

The most commonly used alloy is the chromium-cobalt alloy because of its high elastic modulus, which is a feature that reduces the stresses in the proximal cement layer. The medial section of the stem should be wide in the transverse section. Preferably, the lateral edge should be even wider. Thus, during compression, the load is balanced over the proximal cement mass. The onset of failure in cemented components is seen in the vicinity of the prosthetic-cement complex.

The stem should be planned to fill 80% of the transverse section of the medullary canal and the femoral component should ideally be inserted in the neutral position, in valgus position, or in varus position below 5° [7]. The risk of progressive loosening, cement fracture, proximal bone resorption is higher in patients in whom the prosthesis is inserted in varus positions above 5°. A cement layer of 2 mm thickness should be positioned 4 mm distal of the metaphyseal region of the proximal femur, and second-generation or third-generation cementing technique should be used in order to achieve the stability of the femoral component, lengthen the survival period of the implant and prevent loosening [8].

2.3 Cementing techniques

Along with the advances in surgical techniques, cementing techniques have also improved [9].

2.3.1 First-generation cementing technique

In this technique, cement is mixed manually. It is a technique that requires the least preparation of the medullary canal for prosthesis fixation. The femoral canal is opened, washed and aspirated. Cement in the dough form is applied by fingers. The prosthesis is placed manually in the neutral position (without varus or valgus). The shape of the femoral handle is sharp-edged to ensure high force transmission.

2.3.2 Second-generation cementing technique

The cement is mixed manually and applied using a "cement gun." The spongious bone in the medullary canal is removed off till the endosteal surface, and is dried after brushing and pulsatile irrigation. Plug is inserted into the medullary canal to prevent distal cement extravagation. Following the retrograde application of the cement, the prosthesis is placed in the neutral position manually or using the distal centering methods. The sharp corners of the prosthesis are rounded to increase the resistance of the cement mantle against fractures.

2.3.3 Third-generation cementing technique

In this technique, the cement is mixed in vacuum or centrifugation and applied with a cement gun. The medullary canal is cleaned to the endosteal surface. After brushing and pulsatile irrigation, the adrenaline-impregnated buffer is placed on the medulla and then dried. Cement is applied in retrograde form under pressure using a cement gun. Distal and proximal centralizers are used for the neutral placement of the prosthesis. The surfaces of the proximal and distal surfaces of the prosthesis have been treated to ensure proper load transfer to the cement.

The difference between first-generation and second-generation cementing techniques is primarily due to attempts to ameliorate the bone-cement gap. These attempts aim to avoid aseptic loosening associated with the fixation failure in the bone-cement interface resulting from fractures in the cement mantle. The third-generation cementing technique attempts to fix the cement-metal integration [10].

2.4 Cementless prosthetics

If the arthroplasty is to be long-term and durable, it is essential to maintain the mechanical balance between the prosthesis and bone surface. There are special requirements for prostheses to be integrated without cementing, which can be grouped under four sections: [11].

a. The intraosseous canal where the prosthesis is placed should be as small as possible for the press fit insertion of the prosthesis but without damaging the physiological biomechanics of bone.

b. The initial fixation of the endoprosthesis must be tight. It should reduce the likelihood of a second surgery as much as possible.

c. The design, stabilization and mechanical properties of the prosthesis must take the forces affecting the system in all directions into consideration. Some non-physiological forces may initiate bone resorption. It may even increase the risk of loosening even in cases with good primary implantation of the prosthesis.

d. The bone tissue should not be damaged during implant placement.

2.5 Fixation mechanism of the cementless total hip prostheses

Fixation is thought to happen in two stages in cementless THAs.

2.5.1 Macroscopic fixation

Also called "primary fixation," this stage of fixation aims to stabilize the prosthesis in the bone until microscopic fixation is achieved [12].

2.5.2 Microscopic fixation

Microscopic fixation is also called biological fixation. The phenomenon which means the ingrowth of the surrounding bone tissue into the prosthesis, and the trabeculation and remodeling of the bone, aims to achieve the stability of the prosthesis. In case of using a non-conforming prosthesis, the process will fail due to the resulting micro-movements. This type of fixation aims to provide bone growth directly towards the bone surface. Studies have shown that bone mineralization can develop on the titanium surface and in dependency to the porous surface configuration [12, 13]. A minimal gap of 5 micrometers (μm) is required to achieve bone growth and potential mineralized bone penetration between porous structures. This is the minimum range that allows vascularization. If the gap is between 5 and 50 μm, fibrous penetration towards the implant may be observed. Only if the gap is between 50 and 500 μm, bone penetration to the implant is possible. Therefore, the size of the pore should be between 50 and 350 μm, and preferably between 50 and

150 μm [14]. When the distance between the bone and the prosthesis is 1.5–2 mm and above, bone penetration is not sufficient due to adverse effects of micro movements. Bone penetration into the implant starts at the third week and reaches its maximum level in 6–8 weeks [15].

2.6 Response of the bone tissue to the implant

In a healthy hip, the loads passing through the joint will be transmitted distally through the femur medial cortex. While the body weight is born by the bone alone, the load is transferred to the bone through the prosthesis after THA. In this case, the point where the load is transferred from the prosthesis to the bone gains importance. The initial prosthetic designs allowed for minimal transfer of the load to the proximal medial cortex, which in turn led to stress shielding [16]. The continuity of the physiological stimulus is necessary to preserve the bone mass and prevent the development of osteoporosis. Stems with a larger diameter lead to more bone resorption than small stems [16, 17]. Bone hypertrophy is one of the results of transferring the stress load to the bone. Spongious hypertrophy in the proximal femur or cortical hypertrophy at the end or perimeter of the distal stem is observed. Therefore, distal cortical hypertrophy is not a sign of loosening, but rather the result of transferring the load from the distal to the bone [18]. Tight fit of the prosthesis at the distal and metaphyseal and distal integrations are crucial in the distribution of the loads. Optimal metaphyseal and distal integrations will significantly reduce the effects of torsional and vertical forces, and also ensure optimal transfer of the load to the bone. A tight fit of the femoral stem is necessary for a painless postoperative period. The use of porous, hydroxyapatite-coated stems, or press-fit stems, is used to achieve a rigid fixation of the proximal part of the femoral stem. Elastic fixation at the distal part is desired, thus, osteopenia in the proximal part of the femur due to lack of stimulus is avoided.

2.7 Cementless acetabular components

One of the most important advantages of THA is the successful development of cementless acetabular components. The loosening of the cemented acetabular components in elderly patients after the first decade and the loosening in young patients seen during the first decade, necessitated a revision surgery in this group [19]. Most cementless acetabular cups are porous, hemispherical cups. These cups, placed tightly in the press-fit cavities, are added projections called "pegs" and "spikes," and screws to ensure primary stability, in particular rotational stability [19].

Increasing the stability of the cups using screws ensures fast ingrowth. However, it also carries disadvantages, such as the risk of injury to the pelvic vessel and nerve, osteolysis between the screw and the cup, damage to the polyethylene surface, and screw breakage [4].

Acetabular cups, called "expansion cups", are also in use. These cups are placed in the acetabular bed by pushing and after removing the device that holds it, it springs back like a bow and holds on to the bone with the spikes on its outer surface [20].

Metal cups contain self-locking or self-screwing polyethylene, produced from high-molecular-weight polyethylene. While the thickness of the metal outer cups is too thick to allow for fatigue fracture, a 5 mm thickness is recommended for the polyethylene section as it cannot meet the stress with a thickness below 5 mm. Normally, the acetabulum makes an angle of 55° with the transverse axis. The angle at which the stability of the acetabular component is best is 45°. However, placements between 35–55 and 15–20° of anteversion are considered normal. Placement of components outside these limits is predisposing conditions for forward and backward dislocations. The metal cup is placed in the acetabulum in a fashion that would better grip the superior and posterior parts [21].

2.8 Cementless femoral components

The main objective in using prostheses with a porous surface is to enable the growth of bone and its attachment to the prosthesis and achieve a biological fixation. In order for the bone to grow into the pores, primary stability of the stem during surgery and a full contact between the porous surface and live bone are required.

The shape of the porous stems, materials they are made, the location and the size of the pores show differences with each type of prosthesis. Two types of materials are used in prostheses with a porous structure. These are either made of titanium alloy, whose porous surface is made of pure, titanium fiber or made of cobalt-chromium alloy and with cobalt-chromium beads sintered to the implant. Results with both alloys have been proven to be satisfactory. However, titanium is recommended due to its high biocompatibility, high fatigue strength and low elastic modulus [22].

There are two forms of the femoral stems of the cementless porous hip prostheses; anatomic and straight. The ones with an anatomical form have a backward angulation in the metaphyseal section and a distal angulation in the distal section, in accordance with the inclination of the femoral canal. Anatomic prostheses are produced for the right and left side, with a neck properly anteverted. During the placement of anatomic prostheses, femoral medulla should be carved a little more so that the inclinations on the prosthesis can easily fit. In both types of prostheses, the aim is to fill the medullary cavity optimally, provide rotational and axial primary stability and to provide optimal load distribution by providing the broadest area of contacting surfaces between the bone and prosthesis.

The pores are generally located in the 1/3 upper metaphyseal section of the femoral component. Bone-prosthesis adhesion in the metaphyseal part ensures better absorption of the proximal loads, which in turn increases the success of long-term fixation of the stem.

The use of biologically active calcium phosphate ceramic materials has increased in recent years. Of these, tricalcium phosphate and hydroxyapatite are the most commonly used ones. These materials, which are placed as a thin layer over the surface of the prosthesis, provide a good fit to the bone and allow penetration into the bone. Hydroxyapatite provides a good osseointegration with its osteoconductive effect. The chemical structure of hydroxyapatite is similar to the bone mineral structure. It has been shown that haversian structures directly integrate with hydroxyapatite on contact surfaces with no fibrous structures, inflammatory or osteoclastic cells being observed [23].

2.9 Preoperative planning and evaluation of the patient

Preoperative planning and implant selection are of great importance in revision total hip prosthesis. The knowledge of bone stock and characteristics of the implant applied to the patient during preoperative planning and the availability of appropriate instruments and implants will increase the success of the surgery. Knowing the patient's functional status and the comorbidities before surgery will be important in drawing the limits of the intervention.

The preoperative examination starts with observation. The soft tissue surrounding the hip and the general condition of the skin is observed. Incision traces from previous surgeries are identified. Patient's gait and general posture are evaluated. The range of motion of the hip and adjacent joints, fixed or functional deformities are identified. For example, if the acetabular component is applied to the patient with excessive lordosis with standard forward and lateral angulation, insufficient tissue coverage and instability may develop following the improvement of lordosis [24]. Therefore, it should be decided whether the deformation of the lumbosacral joint is constant.

Scoliosis, poliomyelitis, developmental hip dysplasia, degenerative lumbar or thoracic disc problems and spinal fusion history should be investigated in the patient with leg length discrepancy and should be taken into account in surgical planning. The length discrepancies between the lower extremities should be determined. The "apparent length difference" is assessed by the distance measured from the umbilicus to the medial malleoli. With the blocks placed under the short leg, the pelvis is balanced and the "functional length difference" is determined. The "actual length difference" is measured by the distance between the anterior superior iliac spine on both sides and the medial malleolus. This is the most reliable clinical method, however, the method provides different according to the position of the extremity or pelvis when contracture is present [25]. Especially in the extremity where deformities such as knee contracture are present, the most definitive diagnosis method in determining the length difference is computed tomography (CT) in which the femur and tibia lengths can be measured separately [26].

For a successful surgical planning, the condition of the extremities and the joints which will not be operated should be also investigated during physical examination [27].

Direct radiographs to be taken preoperatively include the full pelvic anteroposterior (AP) radiograph focused on the symphysis pubis and full AP and lateral radiographs focused on the center of the affected hip. The pelvic radiograph is used to assess the length difference between the affected and contralateral hip joints. In particular, the structure of the femur and acetabulum are examined on hip radiographs. AP radiographs are taken in the supine position and, if possible, with the leg internally rotated at 15°. Thus, the full AP image and the actual offset of the femur with an anteverted neck at 15° are obtained. If internal rotation of the hip is not possible due to pathology, the other hip is used for evaluation [28]. Lateral radiographs are used to determine the anatomy of the femoral canal and its association with the piriformis fossa [29].

Rheumatoid arthritis, ankylosing spondylitis, Paget's disease or metabolic diseases weaken the subchondral bone and therefore the center of motion shift towards medial in case of acetabular protrusion. Lateralization of the hip's center of motion, preparation of the allograft for reconstruction of the cavity which may occur in the medial area or the necessary tools to remove the femoral head should be planned before surgery.

The femur may shift towards the superolateral due to acetabular insufficiency in hips with dysplasia. As the actual acetabulum may be smaller than normal and have inadequate bone stock, preoperative preparations may avoid potential problems in these patients. Keeping the hip center high may be an option when reconstructing the acetabulum. If the hip center is preferred to be lowered to the anatomical level of the acetabulum, acetabular components with a small diameter (40–42–44 mm) and with a fitting head and stem should be prepared. In addition, the femoral head obtained after osteotomy can be used to support the superior of the acetabulum to provide full coverage in the actual acetabulum. Another important problem that may be encountered when lowering the acetabulum to its actual position will be the vascular and nerve problems that may develop as a result of prolongation of the extremity. In particular, an elongation of more than 2.5 cm may require femoral osteotomy as it increases the potential risk [30].

2.10 Indications for total hip arthroplasty

Total hip arthroplasty is an irreversible, radical decision in hip-related diseases. Total hip prosthesis is generally recommended in two cases. The first is the presence of a chronic disease in the hip joint, which is often associated with pain and functional limitation. Degenerative and inflammatory-based diseases of the hip joint can be evaluated in this group. They can show a fast or slow progress. In addition to leg length discrepancy, limping, pelvic imbalance and related spine problems can be observed. The latter are the conditions that cause bone defects such as hip fractures, pseudoarthroses and peripheral tumors [31].

The most important finding for the decision of THA is pain. Before recommending the patient THA, a major surgery of the hip, all conservative methods such as weight loss, analgesic treatment, reducing the level of activity on a reasonable scale, choosing a job that requires less activity than a physically active job, and walking cane should be tried. These methods usually reduce the patient's complaints. Ultimately, either surgical treatment becomes unnecessary or surgery is delayed for a long period [32].

If the patient continues to experience pain in daily works, walks shorter distances, has pain despite analgesics and the changes in activities, and experiences nocturnal pain in particular despite all conservative treatment methods, THA is indicated [33].

2.11 Contraindications for total hip arthroplasty

The success of THA relies on careful patient selection and deciding the ones fit and unfit for THA. THA is a major surgical intervention in which important complications can develop and the mortality rate varies between 1 and 2% [34, 35]. For this reason, when THA is indicated, the patient should be evaluated carefully regarding the presence of systemic diseases which will not allow for a major surgery. Therefore, the necessary consultation of the patient should be performed in the postoperative period. It should be kept in mind that some patients may have cardiopulmonary, metabolic, genitourinary and liver problems, hypertension, or hidden malignancies that need to be corrected before major surgical intervention.

Definite contraindications for THA include; the presence of an active infection in the hips or other areas outside the hip, and the presence of systemic diseases which will significantly increase the morbidity or mortality rate of the patient [36]. Charcot joint, loss of abductor muscles, rapidly progressive neurological diseases, dementia and successful hip arthrodesis are reported to be relatively contraindicated [37].

3. Surgical approaches

When performing hip arthroplasty, the ideal surgical approach should provide adequate space for the femoral neck incision, head removal and access to the acetabulum while keeping the damage to muscle functions at minimum. Surgical approaches may vary based on whether the patient is lying on his back or side, having had a greater trochanter bone incision and whether the hip is pulled forwards or backwards. The most commonly used approaches in hip arthroplasties are; anterior, anterolateral, lateral, posterior and posterolateral approaches. Each surgical approach has several advantages and difficulties. There is no ideal implant model or system that will fit and be used easily in every situation for each patient. For this reason, the surgeon must have a general knowledge about the design of the prosthetic elements, and about its weaknesses and strengths. Implant selection should be made by taking the patient's needs, the time the implant should survive, the patient's activity level, the quality and size of the bone, the implants and surgical instruments available and of course the surgeon's experience into account.

3.1 Anterolateral approach

The greatest advantage of this procedure is that the patient lies in the supine position. Thus, orientation of the patient is easier, the length of the leg is easier to evaluate during surgery and the appearance of the acetabulum is much neater [38]. Lower dislocation rates have been reported with this approach [39, 40]. The major disadvantage of the approach is the damage to the gluteus medius localized at the anterior of the greater trochanter and damage to the superior gluteal nerve located 5 cm proximal of the greater trochanter, which may lead to limping [41].

3.2 Direct lateral approach

This approach has a lower dislocation rate compared to the posterior approach [42, 43]. While lower rates of neurological complications have been reported compared to the anterolateral approach, it has been shown that the rate of limping due to gluteus medius injury is higher than the posterior approach [44]. In the lateral approach, the splitting of the gluteus medius starting from the upper end of the greater trochanter major to 6 cm towards the proximal puts superior gluteal nerve at risk, thus, caution should be exercised [45].

3.3 Posterior approach

It is a safe method to reach the hip joint easily and quickly. The main advantages of this approach are that it does not damage the abductor mechanism, does not impair the functionality of the iliotibial band, and it allows for rapid rehabilitation in the postoperative period. In this approach, while retraction is more comfortable, orientation of the patient is more difficult. Compared to the anterolateral approach, there is less bleeding and better preservation of the abductor muscle strength, however, higher hip dislocation rates have been reported [46, 47]. In addition, in case of failing to pay due attention, the risk of damage to the sciatic nerve is high with this approach [48].

4. Rehabilitation

Following THAs, most of the patients experience some functional deficits and disorders non-concurrent with pain. Muscle weaknesses and muscle atrophies may be permanent. Asymmetrical extremity loading in functional activities and Trendelenburg gait due to the weakness of the abductor muscles of the hip are the most common problems. Functional disorders can lead to a decrease in mobility and physical activity, and dependency in daily life. Therefore, the rehabilitation of the patients after surgery is crucial.

In THAs, the rehabilitation process should begin with preoperative evaluation, followed by training and rehabilitation. An early and intensive rehabilitation program should be applied to reduce early muscle strength and function loss after THA. The postoperative rehabilitation program includes prevention of complications, reeducation of the muscles, strengthening and flexibility exercises, gait and balance training, functional exercises and home exercises. In order to prevent complications, patients should be trained about dislocation positions immediately after the surgery and precautions should be taken during their mobilization. Early rehabilitation includes active ankle pump, gait training, low impact isometric exercises, and isotonic exercises for hip abductors, extensors and knee extensors. If cemented THA was performed, full weight-bearing is allowed with the use of double crutches. For cementless THA patients, walking with aids or partial weight-bearing is allowed for 6 weeks. This program can be extended until the 12th week [49].

The use of aquatic therapy to stimulate early healing, low-frequency electrical stimulation to strengthen the weak muscles, and biofeedback to alter the load distribution provide additional benefits [50].

The exercise program in the late term consists of eight exercise groups, focusing on functional tasks, activities of daily living, balance, strength, endurance and cardiovascular fitness. In order to ensure cardiovascular compliance, patients are directed to non-stressful sports and exercises.

Arthroplasty techniques and the rehabilitation programs associated with them have improved in recent years [51].

5. Complications

5.1 Complications during surgery

The worst operative complication recorded in the literature is the main iliac vein rupture following the perforation of the medial wall during acetabular reaming [52]. The same complication has also been reported during the screwing of the acetabular cups of some cemented and cementless prostheses [53].

Another important complication observed is nerve lesion. The prevalence rate varies between 0.7 and 3.5% in primary arthroplasty and may go up to 7.5% in revisions [53].

Another complication, femoral shaft fractures is easier to avoid than to treat. Fitzgerald et al. reported a 17.6% rate of fracture during cementless hip arthroplasty and a rate of 3.5% in revision surgeries [54].

5.2 Early-term postoperative complications

Since hematoma lays a suitable ground for infection, which is one of the most important and feared complications of THA, it is necessary to pay attention to hemostasis during surgery. The main part of the treatment is to prevent secondary infection of hematoma.

Previous hip surgery or revision total hip replacement, posterior surgical approach, incorrect positioning of one or both of the components, femur catching the pelvis or residual osteophytes, wedging of the neck of the femoral component to the edge of the acetabular component, inadequate soft tissue balancing, insufficiency or weakness of the abductor muscle group, avulsion or pseudoarthrosis of the greater trochanter, incompatibility or improper positioning in the perioperative period are the factors that cause dislocation. In the literature, the incidence of dislocation following THA has been reported to vary between 1 and 3%. There is a higher risk of dislocation in revision surgeries compared to primary surgeries [55].

Infection may develop 3 months after THA. These infections are classified as deep and superficial infections. Those who do not penetrate through the fascia are called "superficial" and those who penetrate beyond the fascia are called "deep" infections [56]. The incidence of the infections varies between 0.4 and 3% [57].

Thromboembolism and pulmonary embolism are the most serious complications seen after THA. It is the most common cause of death in the first three postoperative months and is responsible for 50% of the postoperative mortality following THA [58].

5.3 Late-term postoperative complications

Unceasing and unexplained pain that continues from surgery indicates an infection with a slow course. In general, pain is present both at rest and during active weight-bearing. Deep infections in the late term necessitates the removal of the implants in almost all patients.

Heterotopic ossification has an incidence rate of 3–5%. Ankylosing spondylitis is more common in cases with previous posttraumatic arthritis, hypertrophic osteoarthritis and heterotopic ossification [59].

6. Conclusion

Total hip arthroplasty is a surgery performed to provide painless movement of the hip joint and to gain the muscles, ligaments and other soft tissue that control the joint functionality. Hip arthroplasty is a surgical method with very successful results and performed in the presence of pain due to hip arthritis, avascular necrosis, ankylosing spondylitis and the proximal end fractures of the femur.

Total hip arthroplasty is a surgical treatment modality successful in eliminating the hip problems that cannot be solved with medical treatments and has an increasing worldwide popularity. But it should be kept in mind that this success of THA relies on proper patient selection, precise planning before surgery, selection of an implant compatible with the indication, and implementation of an effective rehabilitation program following surgery.

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