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Review article

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Comparative evaluation of the clinical efficacy and safety of surgical approaches in total hip arthroplasty

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Abstract

Background Advanced coxarthrosis is a leading cause of disability in patients. Total arthroplasty is regarded as the "gold standard" for the treatment of hip pathologies that are not amenable to conservative treatment. Arthroplasty introduced into clinical practice has significantly improved functional status of patients. The data are largely contradictory and indicate certain difficulties and risks at the stages of treatment and rehabilitation of patients after surgery. The shortcomings can be overcome by improving the treatment methods for the cohort of patients based on the results of large-scale comparative studies exploring the effectiveness of different approaches to all stages of treatment of arthroplastic patients. The **objective** was to search for the most justified and promising surgical approaches in terms of clinical efficacy and safety of total hip arthroplasty (THA). **Material and methods** The search for publications was produced using the databases of Scopus, PubMed and the electronic scientific library eLIBRARY in Russian and English languages using the keywords: total hip arthroplasty, minimally invasive approach, anterolateral approach in THA, direct lateral approach in THA, posterior approach in THA, comparative assessment of approaches in hip arthroplasty, advanced replacement techniques, incidence of postoperative complications in THA, direct anterior approach in THA. **Results and discussion** A number of studies have shown that interventions using direct anterior access (DAA) are characterized by less blood loss, less frequent blood transfusions, less operating time and shorter hospital stay. There was a more rapid recovery of the hip function during early postoperative period with less need for opioid analgesics with DAA. Complication rate was higher with DAA than in the comparison group, which directly correlated with the learning curve. **Conclusion** DAA was shown to be an advanced approach that resulted in enhanced clinical efficacy and safety of surgical treatment in the majority of patients with coxarthrosis with sufficient experience of the surgeon. The method can be considered as low-traumatic. Unlike other approaches, DAA was accompanied by less injury to intact tissues; smaller skin incision; less blood loss; precipitated postoperative rehabilitation; less severity of postoperative pain and less need for opioid analgesia. However, DAA is inferior to classical approaches in primarily complicated hip pathologies.

Keywords: direct anterior approach, total hip arthroplasty, minimally invasive approach, duration of surgery, pain, postoperative complication, length of inpatient stay

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INTRODUCTION

Musculoskeletal disorders (MSD) are now rank as the second leading global cause of years lived with a temporary disability and the third cause of disability and mortality. There has been a sharp rise in the number of MSD diagnoses in recent decades with osteoarthritis (OA) being the most common condition in older individuals. Individuals aged 65 years and older report an overall prevalence of knee and hip OA of more than 40 % [1]. As the average age increases, the incidence of OA of the large joints of the lower extremities increases and causes a significant social and economic burden on the healthcare system [2, 3]. It is widely stated that OA is the leading cause of disability among adults due to movement limitations and impaired ability to self-care. pain, which is the leading manifestation of the disease, also significantly reduces the quality of life of this category of patients. The dominant symptom of OA is persistent pain having a significant impact on quality of life. Total hip arthroplasty (THA) is considered the gold standard for the treatment of advanced coxarthrosis. The development and introduction of THA into clinical practice has contributed to a significant improvement in the functional condition of large cohorts of patients [4]. Today it is one of the most frequent elective operations performed in economically developed countries, and in the United States, the intervention is associated with most significant expenditures of Medicare spending for inpatients.

Indications for THA include signs of pathological changes in the joint causing severe pain and/or disability. Most patients suffering from coxarthrosis have concomitant diseases including cardiovascular and respiratory conditions, diabetes mellitus, rheumatoid arthritis and chronic infection [5]. Complex large joint intervention and implantation of a prosthesis are traumatic factors for the bone and the soft tissues surrounding the joint. The factors can be associated with complications and revision operations. Despite the high efficiency of THA, about 6% of patients require repeated interventions within 5 years [5]. A technologically correct surgical intervention, the presence of certain concomitant diseases influence patient outcome after total knee arthroplasty in accordance with the concept of risk factors. A number of authors suggest that comorbidities (such as congestive heart failure, previous myocardial infarction, diabetes mellitus, previous transient ischemic attack or stroke, chronic obstructive pulmonary disease, renal failure, hemiplegia, ascites and/or varicose veins of the esophagus and disseminated cancer) are a risk factor for postoperative mortality and complications of varying severity, an increased need for blood transfusions and increased hospital stay for THA patients [6]. The risk of complications is also higher in patients with alcohol use disorders, mental disorders, psychological symptoms of depression. Operating time, the length of in-patient stay, preoperative detection of bacterial strains resistant to antibacterial drugs, an increased concentration of serum C-reactive protein, urinary tract infections are reported as risk factors [7]. The older age of patients and concomitant diseases are significant predictors of infectious complications. Ischemic heart disease, including previous myocardial infarction, chronic heart failure, liver disease, kidney dysfunction increase the risk of complications of THA patients [8].

THA is an effective treatment for patients with advanced coxarthrosis improving severe pain and motor activity. With increasing operative interventions in recent years, growing expectations of patients, increased number of multimorbid patients, the choice of the appropriate surgical approach for arthroplasty can reduce adverse outcomes of surgical treatment of OA. Careful planning of all stages of surgical intervention, including the choice of implant design and fixation technique, the type of surgical approach determined by the surgeon according to indications, and anesthesia can facilitate successful THA. Although various approaches to THA have been offered authors comparing the posterior, anterior, and lateral approaches report no consensus regarding the choice of the optimal surgical approach to ensure the effectiveness and safety of surgical treatment and a low risk of postoperative complications, in multimorbid patients with the same indications, in particular [9, 10].

The objective was to search for the most justified and promising surgical approach to ensure clinical efficacy and safety of THA.

MATERIAL AND METHODS

The search for publications was produced using the Scopus, PubMed databases and the electronic scientific library eLIBRARY in two languages: Russian and English. The keywords included total hip arthroplasty (THA), minimally invasive approach, comparative assessment of approaches in THA, antero-lateral approach in THA, direct lateral hip replacement, hip posterior approach, hip replacement recovery, advanced arthroplastic technique, complication rate for THA, direct anterior hip replacement.

Inclusion criteria were non-randomized controlled trials published in Russian and English; studies that reported, used, or evaluated a direct anterior approach for THA for comparison purposes; studies in which the authors evaluated the effectiveness of direct anterior, anterolateral and posterior approaches in terms of surgical technique, operating time, intraoperative blood loss, severity of pain, length of stay in the hospital; postoperative complications. Exclusion criteria were studies conducted on biomannequins; studies reporting direct anterior access performed in a robot-associated manner; case reports, reports on surgical techniques and editorials.

RESULTS

Surgical approaches for THA: general information, topographic and anatomical considerations

Many options for surgical approaches in various modifications are described in medical literature. Classical approaches include posterior, anterior-lateral, direct lateral (Harding access) approaches. Hip replacement surgery using smaller incisions and utilising the direct anterior approach has been performed in Europe and the USA for over 10-15 years [11].

Posterior approach The patient positioned on the side, pronated. Landmarks include anterior superior iliac spine (ASIS), posterior superior iliac spine, greater trochanter, iliac crest. The operation includes skin incision, incision of tensor fascia lata fascia, the gluteus medius muscle is retracted medially, the short external rotator muscles of the hip are cut away from the proximal femur, the capsule is dissected in a T- or H-shape, the head is dislocated due to internal rotation of the limb [12]. Advantages include excellent access to the posterior capsule and posterior edge of the acetabulum, good access to the femoral canal, abductors being intact. Disadvantages are poor access to the center of the cavity, risk of injury to the sciatic nerve, risk of postoperative dislocation and injury to the femoral vessels. Conclusion: the access can be used for any prosthesis, easy for the assistant, providing good visualization of the posterior edge of the cavity. The approach is employed for total and unipolar hip arthroplasty to address tumors, nonunions of the femoral neck.

Anterior-lateral approach The patient positioned on the back with the femur raised. Landmarks: ASIS, pubic area, greater trochanter. The operation includes a skin incision, fascia incision, blunt separation of tissues between m. gluteus medius and m. tensor fasciae latae, the joint capsule is exposed with abduction of m. gluteus medius, flexion and external rotation of the leg. The retractor is directly placed under the tendon of the rectus muscle, with m. gluteus medius and minimus partially cut off improves visualization. Advantages: no muscle crossed, excellent stability after surgery. Disadvantages: approach to the femoral canal is limited, injury to the gluteus medius may occur during the treatment of the femoral canal, access to the acetabulum is also difficult. Conclusion: it can be used for implantation of any endoprosthesis, easy for the assistant. This access is used for interventions on the anterior surface of the femoral neck, for hip arthroplasty, arthrodesis in combination with supraacetabular osteotomy.

Direct lateral approach (Hardinge) The patient is supine / semi-lateral decubitus / lateral decubitus. Landmarks: ASIS, greater trochanter, pubic area. The operation includes a skin incision, a fascia incision, the gluteus medius muscle is dissected proximally, then the incision runs down to m. vastus lateralis, the muscles and tendons are retracted from the greater trochanter, the gluteus minimus is separated from the bone and together with the anterior interstitial flap is retracted upwards, the limb is adducted, and the capsule is exposed with retractors and excised, the head is dislocated anteriorly due to external rotation [12]. Advantages: excellent visualization, posterior soft tissues are preserved, the risk of postoperative dislocation is reduced, early patient mobility. Disadvantages: damage to the abductor can cause lameness after surgery, damage to the superior gluteal nerve is possible. This approach allows successful operations on the half of the iliac wing, the roof of the acetabulum and is commonly used in THA.

The approaches described are associated with injury to muscles and tissues to a greater or lesser extent. The direct anterior approach (DAA) is considered as a less traumatic method, since a small incision is made during the operation, and approach to the joint is produced through natural anatomical spaces [13].

Direct anterior approach to the hip was described as early as the 1880s. by C. Hueter and later developed by Smith-Petersen M.N. for hip surgical interventions and pediatric surgery [14]. One of the pioneers of the approach, Keggi K.J. et al., Judet R. et al. [14, 15] used DAA THA in the middle of the 20th century. DAA THA has been widely used over the last two decades due to minimal injury to anatomical structures. The main advantage of the DAA is the preservation of the muscles, primarily the gluteal muscles, which remain intact with this approach. The treatment of femoral neck fractures in elderly patients with comorbidities requires the use of a sparing and time-saving surgical technique. Primary THA meets all these requirements, the intervention can be performed quickly with no need for muscle separation or dissection. The approach allows

early rehabilitation due to minimal muscle trauma. Cichos K.H. et al. [16] suggested that the DAA may lead to decreased mortality in patients with femoral neck fractures. The use of PPD is characterized by a relatively small amount of blood loss [17, 18]. The patients can improve early ambulation capacity because of lower pain severity [19, 20].

Direct anterior approach for THA hip arthroplasty: indications, contraindications, surgical technique, advantages, disadvantages, complications

DAA can be used to rapidly perform the operation on a standard operating table with minimal effort.

The advantages of DAA:

– preservation of muscle structures, the hip abductor muscles contributing to pelvic stabilization;

– smaller skin incision length;

– reduction of blood loss [18];

– accelerated rehabilitation in the first 6 months as compared with the use of other approaches [21];

– lower risk of dislocation compared to the posterior approach [17];

– lower pain severity resulting in decreased need of opioids [22].

The DAA interval can be expanded to treat periprosthetic femoral fractures [23].

The disadvantages of the approach include:

– less opportunity to vizualize the intervention zone;

– greater technical complexity;

– the need for experienced and qualified surgeon;

– the possibility of damage to the lateral cutaneous nerve of the femur;

– the need to use tools specific for the approach including a special bilateral femoral elevator [24].

Indications for DAA are [25]:

– primary or revision hip arthroplasty for osteoarthritis or femoral neck fracture;

– aseptic acetabular component loosening with sufficient bone stock and without the need for proximal extension of the approach;

– head and/or liner exchange.

Contraindications for DAA:

– infection of the skin and subcutaneous tissue at the site of operative approach;

– dysplastic coxarthrosis grade 3-4 according to Crowe classification (1979);

– post-traumatic coxarthrosis and a fracture of the posterior column;

– removal of a metal construct after osteosynthesis;

– pronounced marginal osteophytosis interfering with visualization and surgical manipulations with the need of bone grafting;

– revisions of large acetabular defects that require proximal extension or approach to the posterior column.

Posterior or direct lateral approaches can be employed for the above pathologies.

Spinal anesthesia is normally used with DAA THA. The patient is in the supine position on the operating table to fix the femur in a stable position and easily measure the limb length. The lower extremities are covered in such a way to facilitate crossing of the legs for femur manipulations.

Realyvasquez J et al. [26], Nogler M. et al. [27] suggested the use of lower limb holders to ensure the stable position of the limb with the fixators position to be controlled to check to avoid damage to the peroneal nerve. Dissection of tissues is performed between the tensor fascia lata (TFL) and the sartorius / rectus femoris with DAA THA [27, 28, 29]. The ASIS is used as a landmark for incision. The skin incision is made approximately 2 cm lateral and 3 cm distal to the point. The length of the skin incision is approximately 7-8 cm (Fig. 1) and may be longer. No advantages were found with an incision size of more than 11 cm. The skin incision can be extended proximally or distally any time if needed. Proximal extension of the skin incision beyond the ASIS line is not recommended because of muscle attachments at the site.

The incision is to be extended to the ASIS when dissecting the TFL from the iliac crest. The wound is carefully extended with two retractors to visualize the subcutaneous fat. This is important in obese patients to clearly identify the anatomical structures in the small wound window. The subcutaneous adipose tissue is carefully dissected until the muscle fasciae are visible [28]. The TFL becomes visible with perforating vessels identified in the lower edge after a thorough dissection of the subcutaneous fat layer in front of the white fascia (the part of the iliotibial tract covering the gluteus medius) [31]. With the TFL identified, the fascia of the muscle is dissected at the midpoint, lifted with forceps with a blunt retractor placed under the fascia. The procedure is important to avoid direct or indirect damage to the lateral femoral cutaneous nerve. It is not recommended to expose the nerve because of a risk of scarring, which can lead to compression and painful paresthetic neuropathy [28].

Fig. 1 Making a Bikini incision with skin access, photo taken from the authors' image bank

Then digital separation of the medial fibers of the TFL is produced (Fig. 2). Proximal to this muscle, a curved retractor is introduced at the upper edge of the wound with the tip being oriented towards the ilium and capsule. The fascia is exposed distally with a finger to place the second retractor on the distal edge of the wound, leaving the tip on the proximal femur at the the greater trochanter. The rectus and sartorius muscles are retracted medially with a deep wide retractor exposing the vessels. The vessels are the ascending muscular branches of the lateral circumflex femoral vessels and must be carefully ligated. The tendon fibers, which are the deep layer of the ilio-tibial tract, are dissected to reach the joint capsule [28, 32]. The precapsular fat pad is moved aside with an elevator. A curved retractor is inserted to pull the rectus femoris medially upon reaching the medial side of the femoral neck. Another retractor is placed on the cranial edge of the acetabulum in a similar manner. The curved retractor is pushed around the edge of the acetabulum and held in place. The retractor must be inserted to the iliopsoas muscle dorsally to avoid damage to the femoral nerve and femoral vascular bundle. The tip of the retractor should be perpendicular to the inguinal ligament. An L-shaped incision of the capsule is performed. In this case, it is necessary to ensure that the capsule remains intact under the iliopsoas. The capsule layer is a kind of protection against instruments during bone preparation. A flap of the capsule is formed laterally.

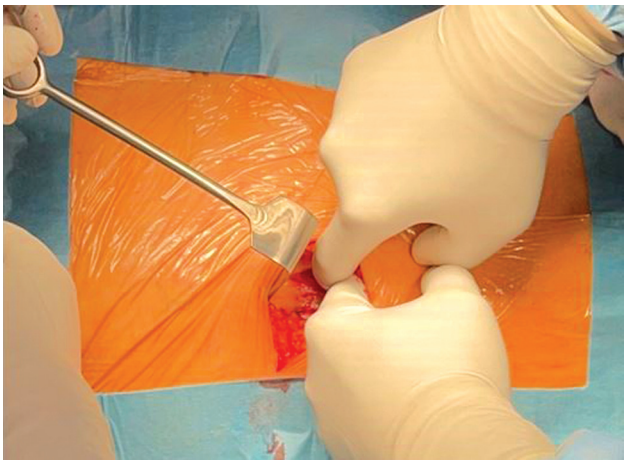

Fig. 2 Finger separation of the medial fibers of the muscle that strains the fascia lata. Photo taken from the image bank of the authors

The approach prevents traumatic rotation of the femoral head during dislocation which can damage blood vessels, nerves and muscles. The wound is extended, retractors placed above and below the wound. Osteophytes on the anterior surface of the cavity are removed with a chisel and Luer cutters. Osteotomy of the femoral neck is performed with an oscillatory saw. The femoral head is removed using a cork screw. It is necessary to ensure that the muscle fibers are not damaged by the femoral head or other fragments (Fig. 3).

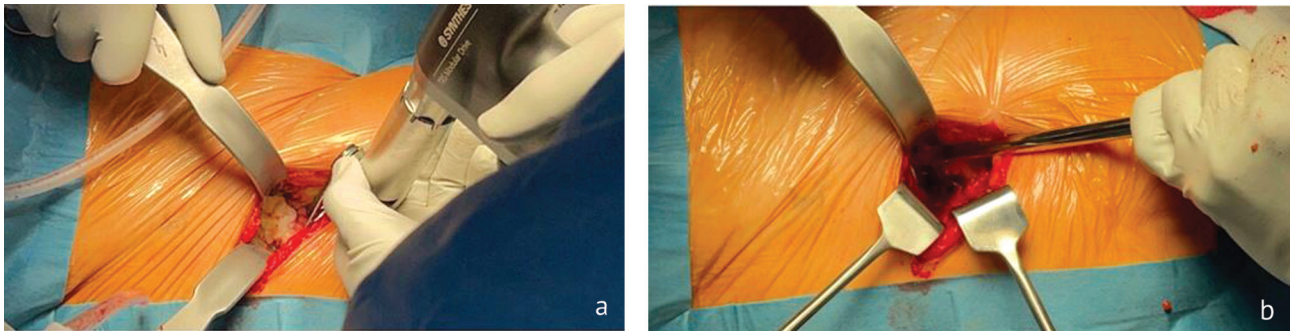

Fig. 3 Osteotomy of the femoral neck (*a*); removal of the femoral head using cork screw (*b*). Photos taken from the image bank of the authors

A double osteotomy can be performed and the bone mass removed with large sizes of the head and cavity, a long femoral neck. The head can be removed with a cork screw as with a conventional osteotomy.

One of the blunt retractors is moved so that the tip is located above the transverse acetabular ligament to move the inferior part of the joint capsule and the iliopsoas tendon. The capsule of the hip joint below can be cut with an electrocoagulator to allow the insertion of a retractor and improve visualization. The sharp retractor is moved to the back of the acetabulum. Once the superior lip and fatty tissue have been removed, the cavity can be processed. Intermediate acetabular reamers and intermediate cups are available for reaming and cup placement. Then the limbs are positioned as digital character four. The femur turns laterally and the medial part placed upwards. The capsule, which is attached to the medial part of the femoral neck is detached if lateral rotation is prevented. The lesser trochanter is palpated, the height of the osteotomy is checked and a second osteotomy is performed, if needed. In the quadruple position, the heel points upward and the intercondylar plane is in a vertical position. Therefore, the vertical axis has a hip torsion of 0°. A hook is inserted into the femur after incision of the fascia lata to pull it ventrally. The bilateral retractor is placed at an angle of 25° to the femoral axis, dorsal to the greater trochanter, with the lower limb turned outward. The femur can be raised to gain direct access to the femoral canal by pulling the hook and pressing down on the femoral elevator. A medial retractor may also be placed to hold the soft tissue medially. In contrast to classical approaches, the attachment sites of the gluteal muscles are not damaged with DAA protecting important stabilizers of the hip joint, hip rotators, MTFL reducing the risk of postoperative dislocation, the severity of pain and accelerating the patient's rehabilitation process [33]. The difficulties reported with DAA include reduction of the femoral head to under the tendon of the rectus muscle. Sun X. et al. [34] recommended placing a curved retractor under the tendon around the anterior edge of the acetabulum for such a case.

Patients with decreased strength of the bone are at risk of a fracture of the femur as with any hip arthroplasty [24]. A distal extension of the approach can be performed for femoral fractures. A damage to the lateral femoral cutaneous nerve is one of the complications manifesting itself as numbness of the distal lateral surface of the femur [23]. Considering the fact that contraindications for DAA include pronounced marginal osteophytosis, advanced stages of dysplastic coxarthrosis, post-traumatic coxarthrosis with a fracture of the posterior column and / or dislocation of the femoral head and other bone conditions when visualization and the work of the surgeon are significantly limited, the approach is more practical for the patients who seek help for joint pathology that does not lead to significant structural deformation and for patients with a low BMI [26]. DAA can be more common with improved quality and availability of diagnosis, and decreased number of patients with advanced coxarthrosis. The above primary complicated pathologies of the hip joint are indications for the use of classical approaches in total joint arthroplasty.

DISCUSSION

Comparative analysis of the efficacy and safety of various surgical approaches for THA has been reported by foreign authors [35, 36]. DAA can be used to maintain the muscle integrity through the use of natural spaces between muscles and blood vessels during. The approach is associated with a lower risk of dislocation and faster functional rehabilitation of patients compared with the corresponding characteristics of the intervention [37, 38, 39]. DAA results in less blood loss, lower frequency of blood transfusions, shorter operating times and shorter hospital days. The lower incidence of postoperative complications allows for a more effective functional rehabilitation of patients compared with the corresponding characteristics of patients who undergo THA using the anterolateral approach (ALA) [38, 40, 41, 42, 43, 44, 45]. However, DAA THA can be associated with a higher incidence of postoperative complications than DAA ALA [46]. Patients can be at risk of developing neuropathy of the lateral femoral cutaneous nerve [47]. Meta-analyses report the results of retrospective and non-randomized controlled clinical trials (CTs), with the level of

evidence being insufficient [48, 49]. Peng L. et al. [50] suggested that comparisons of non-standard methods for THA (piriformis-sparing surgery) and standard approaches should not be reported in the meta-analysis studies, as reported by Wang Z. et al. [18], Higgins J.P. et al. [36], Miller L.E. et al. [49]. A total of 7 randomized controlled trials with 600 participants was reported by Peng L. et al. [50] to compare the DAA and posterior approach for primary THA. The DAA was associated with a longer surgery by a mean duration of 13.74 min (95 % CI 6.88 to 20.61, $p < 0.0001$, $I^2 = 93$ %). There was no significant difference between the DAA and PA groups in the length of the incision, hospital length of stay, blood loss, transfusion rates or complication rates.

The postoperative early functional outcomes were significantly better in the DAA group than in the PA group, such as the Visual Analogue Scale (VAS) score at 1 day postoperatively (MD = -0.65, 95 % CI - 0.91 to - 0.38, $p < 0.00001$, $I^2 = 0$ %), VAS score at 2 days postoperatively (MD = -0.67, 95 % CI - 1.34 to - 0.01, $p = 0.05$, $I^2 = 88$ %) and Harris Hip Score (HHS) at 6 and 12 weeks postoperatively (MD = 6.05, 95 % CI 1.14 to 10.95, $p = 0.02$, $I^2 = 52$ %). The use of opioids as analgesic drugs was significantly reduced postoperatively with DAA compared with patients who underwent THA using ALA and PA [51]. There were no statistically significant differences in long-term functional results of THA using different approaches in terms of VAS score at 12 months, HHS score at 3, 6, or 12 months. There were no significant differences in the radiological findings of the total joint replacements [52]. Comparing DAA with PA in primary THA Miller L. et al. [49] reported a shorter incision length, less pain and a lower need for opoids with anterior approach. Taunton M.J. et al. [39] prospectively examined the clinical and radiographic differences between DAA THA and mini-posterior approach THA (instead of the conventional PA). The approach could increase the heterogeneity of the data obtained.

Wang Z. et al. [18] suggested that DAA was associated with a reduction of the incision length and postoperative blood loss as compared with those in PA. There was no significant difference between the operation time and complications. Jia F. et al. [48] reported a significantly shorter hospital stay and a significantly longer operation time in the DAA group, compared with the corresponding characteristics in the group of patients who underwent PA THA. Meta-analysis performed by Miller L.E. et al. [53] suggested that DAA was associated with a lower incidence of infectious complications, dislocation, and the need for reoperation.

The incidence of neuropathy of the lateral femoral cutaneous nerve differs through the studies. Several authors reported autonomous nerve regeneration and return of sensation to the site innervated by the lateral femoral cutaneous nerve at 1.5-2 months. In the available literature, There are two randomized CTs [46, 47] and several non-randomized uncontrolled studies reported by Rodriguez J.A. et al., Taunton M.J. et al., Jia F. et al. [38, 39, 48]. Different results reported with comparison of various surgical approaches in THA may be associated with different experience of operating surgeons.

Miller L.E. et al. [53] reported early functional results of THA on days 1 and 2 using VAS and the HHS evaluated at 6 weeks with the parameters being significantly better in DAA group as compared to PA patients. Wang Z. et al. [18], Kucukdurmaz F. et al. [22], Jia F. et al. [48] also demonstrated more favorable functional results of the operation with less severe pain and less need for opioid medication in DAA patients after THA as compared to PA group. The results of the study confirmed the previous conclusions and improved the level of evidence. Jia F. et al. [48] reported radiographic outcomes showing little difference in prosthetic position between the DAA and PA groups. Nogler M. et al. [54] reported faster functional rehabilitation of DAA patients early after THA as compared to PA group. Complication rate was higher in the DAA group than in the PA group. Longer duration of the operation and a greater volume of blood loss were reported with DAA than with PA. There were no significant differences in the location of the femoral component and the angle of inclination of the acetabular component with DAA and PA groups, except for the angle of anteversion of the acetabular component. The meta-analysis demonstrated the optimal Harris Hip Score and shorter hospital stay recorded for 6 months with the use of DAA with no statistically

significant differences between the groups, which was consistent with the results presented by Sibia U.S. et al. [55], Zhao H.Y. et al. [56].

Several studies have shown that DAA patients could climb stairs more easily as compared with PA group [57]. DAA can also be associated with improved gait parameters of patients after surgery [21, 58]. There is a faster functional recovery of the hip joint in DAA patients early after surgery. A significantly shorter hospital stay is another benefit of the anterior approach [59]. Short-term benefits of the DAA are reflected in more intensive functional dynamics in the joint in the early stages compared to the use of PA with the advantages being leveled at 6 months. There were no significant differences in the incidence of complications in the DAA group and PA patients [60]. The meta-analysis performed by Nogler M. et al. [54] showed that although the surgeons who performed THA DAA had considerable experience, a higher complication rate, longer operation time, and greater blood loss were observed in DAA patients. That indicated to DAA as more demanding technical approach.

A longer duration of the operation can be associated with a higher risk of infectious complications [61, 62]. The development and implementation of new methods of treatment and medical technologies are inevitably associated with a temporary increase in the frequency of adverse events, which is negatively correlated with the learning curve. It is believed that the operating surgeon must be well trained and have significant experience in hip replacement procedures prior to THA performed with DAA. Both DAA and PA THA exhibited a learning curve in the first 50 cases performed at the start of a surgeon's practice with the risk of postoperative complications being comparable for anterior and posterior approaches [63]. Surgeon mentoring in the first 20 cases should be considered to minimize risk of adverse events [64]. The accuracy of acetabular component orientation is essential for the outcome of total hip arthroplasty [65]. Malpositioning of the acetabular cup is associated with a higher risk of prosthetic displacement, and malpositioning of the femoral component can lead to earlier failure [66]. The results of the meta-analysis show that the use of different approaches for THA is not accompanied by statistically significant differences in the angle of inclination of the acetabular component. Significant differences in anteversion of the acetabular component were shown with an angle being significantly lower by 4.3° on average in the DAA group compared with the angle in PA patients. Although the position of the acetabular component varied among the studies included in the meta-analysis, the mean acetabular tilt and anteversion angle remained within the safe zone [67], regardless of the approach. The position of the femoral component was comparable in both groups with a similar ratio of the femoral shaft in the neutral position of the limb. Nogler M. et al. [54] suggested that the results of radiographic assessment of THA were satisfactory regardless of the surgical approach used. Thus, despite the results of several meta-analytical studies published to date, the findings are still insufficient for the final choice of the optimal surgical approach for THA.

CONCLUSION

Literature review has shown that DAA is a promising approach and can lead to greater clinical efficacy and safety of surgical treatment of the hip OA with sufficient experience of the surgeon. This method can be considered as low-traumatic. Opposed to other approaches, the use of DAA is characterized by:

– less trauma of healthy tissues;
– smaller skin incision;
– smaller amount of blood loss;
– accelerated postoperative rehabilitation;
– ess severe postoperative pain and no need for opioid medication.

However, DAA is inferior to classical approaches in primary complicated pathologies of the hip joint.

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Ethical expertise *All manipulations performed in the human study were in accordance with the standards of the local ethics committee, the Declaration of Helsinki 1964 and later amendments or comparable ethical standards. The formal consent of the local ethics committee was not required for the type of research.*

Informed consent *Not required.*

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