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Early postoperative results analysis of standard and mini-incision posterolateral approach in total hip arthroplasty

Analiza ranih postoperativnih rezultata standardnog i minimalno incizionog posterolateralnog pristupa kod totalne artroplastike kuka

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Abstract

Background/Aim. Total hip arthroplasty is the replacement of the hip joint with an artificial one. Standard surgical procedures involve a long skin incision and extensive dissection of healthy tissue. Mini-incision surgery is a modification of standard operative approaches. In addition to a significantly smaller skin incision, the main difference is based on much less damage to soft tissues, especially the muscles that move the hip. The aim of this study was to compare the early results of the mini-incision and a standard approach in total hip arthroplasty and to determine the advantages and disadvantages of the mini-incision surgical technique. **Methods.** A retrospective study analyzed data based on 63 patients who underwent total hip arthroplasty with a mini-incision and standard approach at the Institute of Orthopaedic Surgery "Banjica", Belgrade from 2004 to 2010. All the patients suffered from primary coxarthrosis. All operations were carried out by the same surgical team. All patients were clinically evaluated before and after the surgery using the Harris Hip Score (HHS). **Results.** The group of patients operated on with the mini-incision approach included 32 patients, while 31 patients made up the group of patients operated on with the standard approach. Comparing these groups did not reveal a statistically significant difference in age, body mass index, surgery duration, and HHS before the surgery. A statistically significant difference was determined by comparing intraoperative blood loss, the amount of drainage fluid after the surgery, and the HHS after the surgery. **Conclusion.** The mini-incision posterolateral approach, compared to the standard approach, apart from an esthetically more acceptable scar, achieves significantly less intraoperative blood loss and better hip function with almost the same risk of complications.

Key words:
arthroplasty, replacement, hip; intraoperative complications; orthopedic procedures; postoperative complications; treatment outcome.

Apstrakt

Uvod/Cilj. Totalna artroplastika kuka predstavlja zamenu zgloba kuka veštačkim zglobom. Standardni operativni postupci podrazumevaju dugačak kožni rez i ekstenzivnu disekciju zdravog tkiva. Minimalno inciziona hirurgija predstavlja modifikaciju standardnih operativnih pristupa. Pored značajno manjeg reza kože, glavna razlika je mnogo manje oštećenje mekih tkiva, posebno mišića pokretača kuka. Cilj rada bio je da se uporede rani rezultati minimalno incizionog i standardnog pristupa u totalnoj artroplastici zgloba kuka i utvrde prednosti i nedostaci minimalno incizione hirurške tehnike. **Metode.** Retrospektivnom studijom analizirani su podaci o 63 bolesnika kojima je urađena totalna artroplastika kuka minimalno incizionim i standardnim pristupom na Institutu za ortopediju „Banjica" u Beogradu u periodu od 2004. do 2010. godine. Svi bolesnici imali su primarnu koksartrozu. Sve operacije je uradio isti hirurški tim. Svi bolesnici su klinički procenjivani, pre i posle operacije, korišćenjem bodovnog sistema po Harisu. **Rezultati.** U grupi bolesnika operisanih minimalno incizionim pristupom bila su 32 bolesnika, a u grupi operisanih standardnim pristupom, 31 bolesnik. Poređenjem tih grupa nije utvrđena statistički značajna razlika u životnom dobu, indeksu telesne mase, trajanju operacije i Harisovom skoru pre operacije. Poređenjem intraoperativnog gubitka krvi, količine drenažne tečnosti posle operacije i Harisovog skora posle operacije, utvrđena je statistički značajna razlika. **Zaključak.** Pored estetski prihvatljivijeg ožiljka, minimalno incizionim posterolateralnim pristupom se, u odnosu na standardni pristup, postiže i značajno manji intraoperativni gubitak krvi i bolja funkcija kuka, uz skoro isti rizik od komplikacija.

Ključne reči:
artroplastika kuka; intraoperativne komplikacije; ortopedske procedure; postoperativne komplikacije; lečenje, ishod.

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Introduction

Total hip arthroplasty (THA) is the replacement of a hip joint with an artificial implant. Artificial joints are designed to enable joint function close to natural. Nowadays, THA is one of the most successful operations in orthopedic surgery. For many years, it has enabled the recovery of normal joint function and the return of the patients to normal life activities [1]. The operative procedures by which total hip arthroplasty is conducted are numerous and quite different. Over time, they have undergone significant changes in order to reduce morbidity and increase the longevity of implants [2]. Furthermore, the implants themselves have undergone significant changes in every respect: metal alloys, design, chemical and physical characteristics of polyethylene and cement have been improved, the contact surfaces are made porous, which ensures biological fixation, etc. All this has made THA a highly successful surgical procedure [3, 4].

Standard surgical procedures involve a long skin incision and extensive dissection of healthy tissue to approach the diseased joint. Apart from leaving large scars, such approaches cause unnecessarily extensive soft tissue damage; thus, all operative and postoperative risks, especially the risk of infection, are increased. As a result, there is a need for an operative technique that will give the same or even better operative results through a smaller skin incision and with less soft tissue dissection [5]. Although the standard approach to hip arthroplasty provides a good improvement in joint function, with long-lasting components and a low percentage of complications, surgeons constantly try to improve the existing techniques [6]. Minimally invasive surgery (MIS) is a modification of standard surgical approaches to hip arthroplasty. In addition to a significantly smaller skin incision, which is up to 30 cm in the standard posterolateral approach, while in the minimally invasive one is 10 cm maximum, the main difference is in much lesser (minimal) damage to soft tissues, especially hip muscles. The incision length mostly depends on the size of the acetabular component in order to ensure its correct placement [7]. The Institute of Orthopedic Surgery "Banjica" in Belgrade has been applying the Dorr posterolateral mini-incision approach since 2004 [8].

The introduction of MIS procedures into total hip arthroplasty has led to great controversy in orthopedic circles. The complete definition of 'minimally invasive' is not clearly determined; hence, many authors consider the terms 'minimally incisional' or 'less invasive' as more appropriate [9]. In addition to providing standard implant durability, the expectations from the MIS technique are that, apart from a more acceptable scar, it enables reduction of blood loss during surgery, reduction of soft tissue trauma, reduction of intensity and duration of postoperative pain, reduction of hospital stay, and acceleration of rehabilitation [10]. The realization of these expectations has been disputed by many authors. There are claims that skin trauma, infection rate, and neurovascular damage are higher than in the case of the standard approach surgery [11]. Some authors emphasize the possibility of malposition of components due to limited visibility and tissue interposition in the operative field. They also claim that the MIS should not be widely used until the degree of risk and benefit of this method is well determined and documented [12].

The aim of this study was to compare the early postoperative results of the mini-incision and standard posterolateral approach in total hip arthroplasty, as well as to determine the advantages and disadvantages of the MIS technique.

Methods

A retrospective cohort study analyzed data based on 63 patients who underwent total hip arthroplasty with a standard and MIS posterolateral approach at the Institute of Orthopedic Surgery "Banjica", Belgrade from 2004 to 2010. All patients suffered from primary coxarthrosis. All operations were carried out by the same surgical team with cementless implants. The patients were divided into two groups based on the surgical technique used to perform the operation. The first group of patients underwent a standard procedure surgery (Standard group) and the second group underwent surgery with an MIS technique (MIS group). The following relevant sociodemographic characteristics were also analyzed: gender, age, and body mass index (BMI).

Depending on the physical characteristics, the length of the incision was determined for each patient individually at the time of the surgery. In all cases, the standard posterolateral surgical approach was used, as well as the Dorr MIS approach. It involves a skin incision in the area of the posterior aspect of the great trochanter from the *vastus tubercle* to the apex of the great trochanter, stratification of the fibers of the *gluteus maximus*, and lifting of the *gluteus medius* and *gluteus minimus*, as well as L incision of the capsule to the *quadratus femoris* [8]. Dedicated Hohmann retractors with long handles and various angulations were used, distancing the assistant's hands from the operative field. Implants were positioned according to Lewinnek's "safe zone" [13] and anatomical references without intraoperative fluoroscopic control. In all patients, the fascia, subcutaneous tissue, and skin were closed by a standard procedure, and the wounds were drained with an aspiration drainage system for a maximum of 24 hrs.

Standard antibiotics and thromboembolic prophylaxis were used: first-generation cephalosporins were administered *iv* for a total of 24 hrs, with the first dose an hour before the surgery. Low molecular weight heparins were administered *sc* until the 35th postoperative day, with the first dose 12 hrs before surgery. The length of the operative incision was measured with a ruler. During the operation, the blood loss was monitored as the sum of the volume of blood in the bottle of the aspiration apparatus and the weight of the gauze used during the procedure. The time from the beginning of the incision to the complete closure of the operative wound was taken as the duration of the operation. After the operation, the volume of drainage fluid in the drainage system was monitored. The patient's condition was assessed daily in the first postoperative week, as well as on an outpatient basis two months after the operation. The follow-up of the patient's condition lasted on average 51 months, the shortest

34, and the longest 63 months. All the patients were clinically evaluated before and two months after the surgery using the Harris Hip Score (HHS) [14].

The two groups of patients were compared according to HHS before and after surgery, considering the blood loss during surgery, the amount of drainage fluid, and the duration of the surgery. Central tendency measures (arithmetic mean and median) and variability measures (standard deviation and minimum and maximum values) were used to describe the data. Student's *t*-test was used for the intergroup comparison of the differences.

Results

The average age of the patients was 53 years. In total, there were 10 (16%) men and 53 (84%) women. Thirty-three patients underwent a right hip joint surgery, while thirty underwent a left hip joint surgery. In the group of patients with the standard approach, there were 31 (49%) patients, while there were 32 (51%) patients in the group treated by the MIS approach. Sociodemographic characteristics of the patients are shown in Table 1.

Comparing these groups did not reveal a statistically significant differences in age, BMI, duration of the surgery, and HHS before the surgery ($p > 0.05$). The BMI in the Standard group was 24.6 kg/m^2, while in the MIS group, the average BMI was 25.6 kg/m^2. The average duration of the surgery in the Standard group was 58 min, while this time in the MIS group was 60 min. The mean value of the HHS before the surgery in the Standard group was 46.77, while in the MIS group, the average value of this score was 44.97. The average length of the incision in the Standard group was 14.4 cm, compared with the MIS group, where it was 7.8 cm.

A statistically significant difference between the two groups was determined when comparing the intraoperative blood loss, the amount of drainage fluid after the surgery, and the HHS after the surgery ($p < 0.01$). In the group with the mini-incision technique, the average blood loss during the operation was 296.6 mL, while this value in the standard approach group was 428.1 mL. By measuring the volume of the drainage fluid after the surgery, it was determined that its average value in the Standard group was 335 mL, while in the MIS group, this value was 220 mL. After the operation in the Standard group, the mean value of the HHS was 94.93, while this value in the MIS group was 97.56. There was also a highly statistically significant difference between pre- and postoperative HHS in both groups of patients ($p < 0.01$). All intra- and postoperative parameters are shown in Table 2.

The complications that occurred in the group of patients operated on using the standard technique were one luxation that occurred one year after the surgery and one verified pulmonary embolism. In the MIS approach group, a deep vein thrombosis of the leg was observed in one patient. There was no delayed wound healing or superficial or deep infection.

Discussion

Over the last four decades, total hip arthroplasty has become one of the most successful operations in terms of improving the quality of life of patients with hip joint disease. Although new advances in anesthesia and faster rehabilitation have had the effect of reducing mortality and morbidity, the surgical approach and technique have changed little during the last few decades [15]. The rationality in introducing less invasive surgical procedures, i.e., the mini-incision technique, is that they represent less destructive surgery with a more acceptable cosmetic result. The possible benefits include less intraoperative blood loss, less postoperative pain, shorter hospital stays, and shorter rehabilitation. However, there are concerns not only in terms of indications that large-

Table 1

Demographic data

Parameter	Standard group	MIS group
Number of patients	31	32
Age (years)	51.3 ± 10.3	54.7 ± 11
BMI (kg/m^2)	24.7 ± 3.8	25.6 ± 3.5
Gender		
male	7 (22.6)	3 (9.4)
female	24 (77.4)	29 (90.6)
Operated side		
right	12 (38.7)	21 (65.6)
left	19 (61.3)	11 (34.4)

All values are expressed as mean ± standard deviation or number (percentages).
MIS – mini-incisional surgery; BMI – body mass index.

Table 2

Operative and postoperative parameters

Parameter	Standard group	MIS group	*p*
Operation duration (min)	58.4 ± 8.9	59.7 ± 9.5	> 0.05
Intraoperative blood loss (mL)	428.1 ± 93.9	296.6 ± 108.1	< 0.01
Operative wound drainage (mL)	335.5 ± 90.6	220.9 ± 82.0	< 0.01
Incision length (cm)	14.4 (13–16)	7.8 (7–9)	< 0.01
Preoperative HHS	44.8 ± 7.9	45.0 ± 6.8	> 0.05
Postoperative HHS	94.9 ± 4.5	97.6 ± 1.9	< 0.01

All values are expressed as mean ± standard deviation or median (minimum-maximum).
MIS – mini-incisional surgery; HHS – Harris Hip Score.

ly depend on body weight but also in the accuracy of implant positioning and, most importantly, the risk of complications [16]. Minimally invasive techniques can be successfully used only by experienced orthopedic surgeons, i.e., the surgeons who have already performed a large number of these operations with standard surgical procedures. For the technique to become widely accepted, it must show an obvious advantage over the standard method of total hip arthroplasty without increasing the frequency of accompanying complications [17].

The justification of the term 'minimally invasive', which should mean a minor intraoperative tissue trauma accompanied by minor bleeding and pain, is questioned by many. The term 'minimally invasive' is increasingly being replaced by the term 'minimally incisional' [18]. Namely, it should be borne in mind that the 'minimally incisional' technique does not have to be a 'minimally invasive' operation [19]. Numerous approaches have been developed in minimally invasive hip surgery that can be classified into two groups: those that save the muscles and those that are mini-incisional. In the case of the techniques that save muscle fibers, the cutting of muscle bodies or separation of their attachments is avoided – an example is the MIS technique with two incisions. Mini-incisional techniques involve shorter skin incisions and less muscle damage compared to their standard equivalents [20]. Under the skin, hip resection, acetabulum, and femoral canal treatment, and even the endoprosthesis itself are the same as in the case of standard surgical procedures. However, it is indisputable that the soft tissues, especially the muscles and the joint capsule, are significantly less damaged, and the blood loss is lesser. As a result, the postoperative pain is less, and rehabilitation is easier and faster. In addition, the patients prefer accepting a small operative scar and increasingly require this type of surgery. The choice of patients is one of the most important factors on which the success of this surgical procedure depends, and it represents the greatest limitations of its application. Most authors believe that patients should not have a BMI greater than 30. Other contraindications are a high degree of hip dysplasia, previous operations on that joint, revision surgery, as well as very pronounced joint contractures [21].

Our results showed that the average value of BMI, HHS before the surgery, and the duration of the operation did not differ in the two observed groups. In the group with the mini-incision approach, a statistically significant lower intraoperative blood loss and a smaller volume of drainage fluid were observed. The length of the incision was reduced by 46% (from 14.4 cm to 7.8 cm). Pavone et al. [22], who analyzed 46 patients with incisions of 8 cm and 15 cm in a randomized prospective study, concluded that there was significantly less blood loss and less wound drainage in the group with a shorter skin incision. On the other hand, Wright et al. [23] did not find any statistically significant difference in blood loss and hospital stay in their patients.

Statistically significantly better HHS was observed after the surgery in the MIS group. The data in the references are not consistent with this score. Chung et al. [16] found no statistically significant difference in their study, while Goosen et al. [24] found that there was a significant difference in their patients, with a significantly better score in the mini-incision group. Dorr et al. [25], as well as Wenz et al. [26], showed in their studies that their patients operated on with the mini-incision technique began to walk earlier and with less need to use orthopedic aids compared to those operated on with the standard approach.

Component positioning is one of the most important aspects of hip surgery. Woerner et al. [27] state a significant impact of the reduced visibility of the operative field due to a smaller incision on the implant placement. Other authors, such as Ogonda et al. [15], disagree with this statement, believing that it largely depends on the individual experience of the surgeon. In their randomized study of 219 patients, the MIS and standard techniques were compared, after which they did not notice a significant difference between the two approaches.

Tan et al. [28] compared the standard with the MIS approach with piriformis muscle preservation in a group of 100 patients. After ten years of follow-up, the authors did not find a difference in hip joint functionality between these two approaches, with almost the same complication rate in both groups.

There were a total of three postoperative complications in our study. In the group that was operated on with the standard approach, there was one luxation and one pulmonary embolism, while in the other group, there was only one thrombosis of the deep veins of the leg. There were no other postoperative complications in the form of components malposition, early infection, or intraoperative periprosthetic fractures. Leg length discrepancies in booth groups were less than 1 cm measured from the superior anterior iliac spine to the medial malleolus. Taking into consideration that the total number of complications is not significant, such rare complications fit the results of other authors [7].

A limitation of this study was the fact that only early postoperative functional results were analyzed, excluding the results obtained during the entire follow-up period.

Conclusion

The attractiveness of the mini-incision technique is obvious due to lower morbidity and faster recovery, which are just some of the advantages. The MIS approach compared to the standard, apart from an aesthetically acceptable scar, achieves significantly less intraoperative blood loss and better hip function in the early postoperative period with almost the same risk of complications. The choice of the patients is one of the key factors on which the success of this operative procedure depends. The results of this study emphasize the benefits that patients have from the MIS and indicate its clear advantages over the standard posterolateral surgical approach. Randomized prospective controlled clinical trials, as well as long-term follow-ups, are needed to fully understand and demonstrate the advantage of this technique over the standard approach.

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