

Patient rehabilitation results after total hip arthroplasty using short-stem endoprostheses

Wyniki czynnościowe usprawniania chorych po alloplastykach całkowitych stawu biodrowego endoprotezami krótkotrzeniowymi i przynasadowymi

Waldemar Wrażeń^{1(A,B,C)}, Krzysztof A. Tomaszewski^{1,2(D,E,F)}, Piotr Golec^{1(B,E)}, Jakub Marchewka^{1(E,F)}, Zbigniew Dudkiewicz^{3(C,E)}, Edward Golec^{1,4(A,C,E,G)}

¹ Department of Trauma and Orthopaedic Surgery, 5th Military Clinical Hospital with Polyclinic in Krakow, Poland

² Department of Anatomy, Jagiellonian University Medical College in Krakow, Poland

³ Hand Surgery Clinic, Department of Orthopaedics and Traumatology, Medical University of Lodz, Poland

⁴ Department of Orthopaedic Rehabilitation, Chair of Clinical Rehabilitation, Faculty of Motor Rehabilitation, University of Physical Education in Krakow, Poland

Key words

total hip arthroplasty, hip joint, short-stem endoprosthesis

Abstract

Introduction: Total hip arthroplasty already has a permanent place among surgical procedures dealing with osteoarthritis, as well as traumatic injuries of the femoral neck. In recent years, there has been an increased interest in metaphyseal-fitting and short-stem endoprostheses, which bring new challenges regarding operating technique and rehabilitation care. The aim of this study was to evaluate functional results of total hip arthroplasty using the following endoprostheses: short-stem, metaphyseal-fitting, and cementless with a standard stem.

Research Project: Retrospective study.

Materials and methods: The research material covers the period between 1993 and 2014 and includes 180 patients operated on due to hip osteoarthritis using total hip arthroplasty. In 96 patients (53.4%) cementless endoprosthesis with a standard ABG-1 stem was used, in 62 patients (34.4%) the Proxima metaphyseal prosthesis was implanted, in 14 patients (7.7%) the BTS short-stem endoprosthesis was used, and in 8 patients (4.4%) TL short-stem endoprosthesis was used. Each patient was evaluated several times using the Harris Hip Score.

Results: Functional results obtained in individual groups of patients who underwent surgery are comparable and consistent, without pronounced differences.

Conclusions: Functional results obtained in analysed total hip arthroplasties were excellent and good in the majority of patients, both in the early and late observation periods. They are comparable with results of total hip arthroplasties with standard stem endoprosthesis. Patients operated on using the described methods do not require a different rehabilitation programme with different biomechanical or clinical characteristics when compared to patients with standard stem endoprostheses.

Słowa kluczowe

aloplastyka całkowita, staw biodrowy, endoprotezy krótkotrzeniowe

Streszczenie

Wstęp: Aloplastyki całkowite stawu biodrowego z pewnością zajmują już trwałe miejsce w praktyce operacyjnej choroby zwyrodnieniowej, a także uszkodzeń urazowych szyjki kości udowej. Na przestrzeni ostatnich kilkunastu lat coraz większą uwagę skupiają na sobie tzw. endoprotezy przynasadowe i krótkotrzeniowe, które niosą ze sobą nowe wyzwania operacyjne i rehabilitacyjne. Celem

The individual division on this paper was as follows: A – research work project; B – data collection; C – statistical analysis; D – data interpretation; E – manuscript compilation; F – publication search

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pracy była ocena wyników czynnościowych alopastyki całkowitej stawów biodrowych z wykorzystaniem endoprotez krótkotrzeniowych, przynasadowych oraz niecementowanych z trzpieniem standardowym.

Projekt badań: Badanie retrospektywne.

Materiał badań: Materiał badań pochodzi z lat 1993-2014 i obejmuje 180 operowanych z powodu zwyrodnienia stawów biodrowych metodą alopastyki całkowitej, w tym 96 endoprotezą niecementowaną z trzpieniem standardowym typu ABG-1, co stanowi 53,4%, 62 endoprotezą przynasadową typu Proxima, co daje 34,4%, 14 endoprotezą krótkotrzeniową typu BTS, czyli 7,7% oraz 8 endoprotezą z krótkim trzpieniem typu TL, co stanowi 4,4%.

Metoda badań: Kilukrotnie wykonywany test czynnościowy Harrisa.

Wyniki badań: Uzyskane wyniki czynnościowe w poszczególnych grupach operowanych są porównywalne i zbieżne, bez wyraźnych różnic.

Wnioski: Analizowane alopastyki całkowite stawów biodrowych u większości operowanych, zarówno w obserwacji wczesnej, jak i odległej, skutkują bardzo dobrymi i dobrymi wynikami czynnościowymi oraz są porównywalne z wynikami alopastyk całkowitych endoprotezami z trzpieniem standardowym. Operowani analizowanymi metodami nie wymagają odmiennych programu rehabilitacji o odrębnej charakterystyce biomechanicznej i klinicznej.

INTRODUCTION

Total hip arthroplasty already has a permanent place among surgical procedures dealing with osteoarthritis, as well as for traumatic injuries of the femoral neck. In recent years, there has been an increased interest in metaphyseal-fitting and short-stem endoprostheses, which bring new challenges regarding technology, operating techniques and rehabilitation care¹⁻⁴. These procedures are intended mainly for young people suffering from osteoarthritis of the hip joint of different etiologies, and their implantation is seen as one of many conditions for patients who have undergone surgery to regain lost motor fitness, providing a considerable improvement to their quality of life, and prolonged usability of the implant^{5,6}. Undoubtedly, an important part of the post-operative procedure, both in the early and late observation periods, is to determine the rehabilitation conditions for the patients who have undergone surgery, especially in conditions of possible complications⁷⁻¹⁰. This context raises many questions relating to the conditions for the rehabilitation of patients operated on using total hip arthroplasty with a standard stem, in comparison with those who have undergone operations with metaphyseal and short stems (Figure 1).

AIM OF THE STUDY

The aim of this study was to evaluate the functional results of total hip arthroplasty using a short-stem and metaphyseal-fitting endoprostheses in early and late observation periods. Above

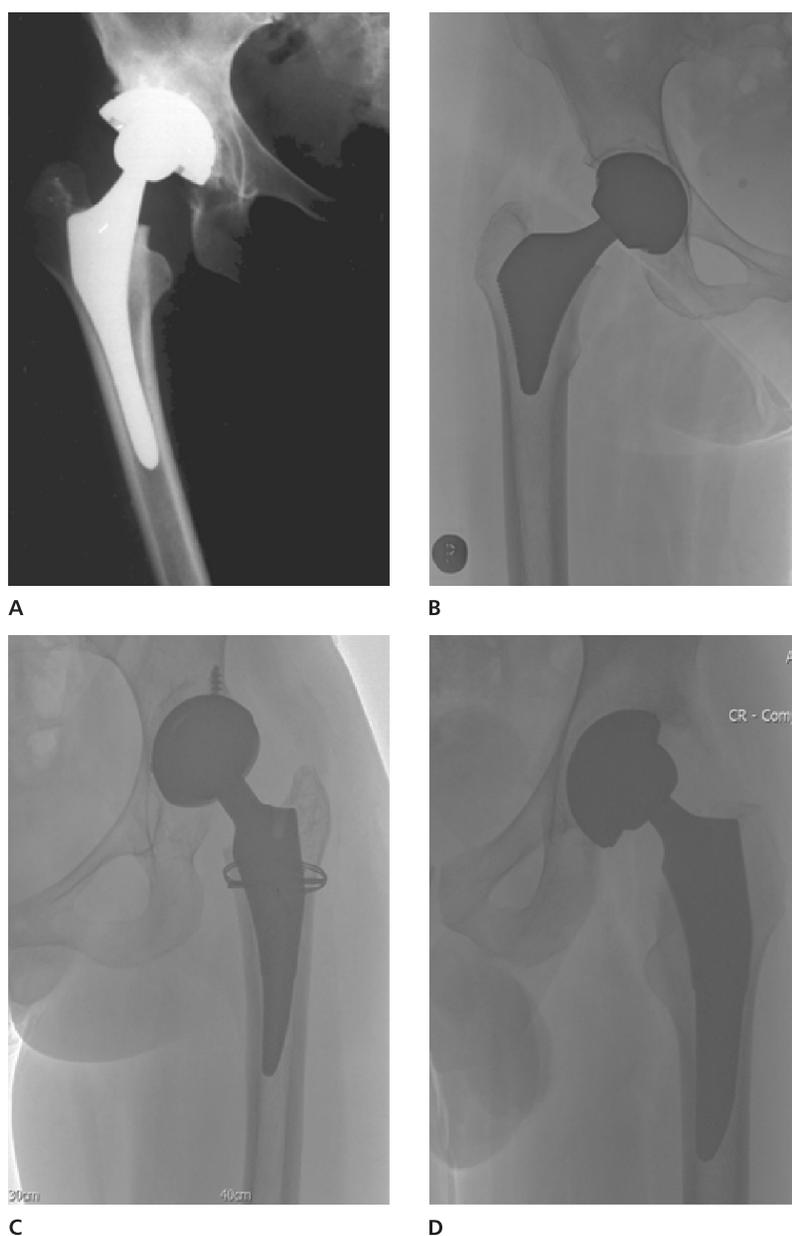


Figure 1

Types of hip joint endoprosthesis: a) ABG-1, b) Proxima, c) BTS, d) TL X-ray pictures in antero-posterior view

all, the aim was to answer the following questions:

1. What are the functional results of surgical treatment for patients with hip osteoarthritis using total hip arthroplasty with metaphyseal-fitting and short-stem endoprostheses, depending on the etiology of the osteoarthritis in early and late observation periods?
2. What are the functional results of total hip arthroplasty using metaphyseal-fitting and short-stem endoprostheses compared to total hip arthroplasty using a standard stem?
3. Does the rehabilitation of patients operated on using total hip arthroplasty with a short stem and metaphyseal-fitting endoprostheses require rehabilitation programmes with different biomechanical and clinical characteristics, when compared to patients with a standard stem endoprostheses implant?

MATERIALS AND METHODS

Research materials

The aim of the study was accomplished based on research material from the Department of Trauma and Orthopaedic Surgery, 5th Military Clinical Hospital with a Polyclinic in Krakow, Poland (5 WSK). The material included three groups of patients (Table 1).

Group I consisted of patients operated on between 1993-1999 due to hip osteoarthritis, using total hip arthroplasty with the ABG-1 cementless endoprosthesis (*Stryker*) and with a standard stem. The group included 96 people: 39 men (40.6%) and 57 women (59.4%). Among the men, idiopathic hip osteoarthritis dominated and was reported in 32 out of them (32.3%). For the remaining 7 men, the indication for surgery was traumatic osteoarthritis. Among the women, idiopathic hip osteoarthritis also prevailed, and was diagnosed in 36 out of them (37.5%). In 17 women (17.8%), osteoarthritis due to developmental dysplasia was diagnosed, in 2 women – post-inflammatory osteoarthritis, and in another 2 women – post-traumatic osteoarthritis¹¹. The age of the

patients included in this group ranged from 32 to 56 years old, with a mean value of 44 ± 9.7 years.

Group II included 62 patients operated on between 2008-2013 in the Department of Trauma and Orthopaedic Surgery, 5th Military Clinical Hospital with a Polyclinic in Krakow, Poland, due to the hip osteoarthritis, using total hip arthroplasty with the Proxima metaphyseal-fitting endoprosthesis. The group consisted of 38 men (61.3%) and 24 women (38.7%). The age of those included in this group ranged from 23 to 62 years old, with a mean value of 46 ± 12.5 years. The group comprised only one man aged 23, and only one woman aged 62. The remaining patients operated on were between the ages of 42 to 54 years old. The etiologic cause of the hip osteoarthritis most frequently reported among the patients was idiopathic osteoarthritis, which was observed in 53 out of them (85.5%), including 37 men (59.7%) and 16 women (25.8%).

Group III consisted of 22 patients operated on between 2013-2014 due to the hip osteoarthritis, using total hip arthroplasty with a BTS (*Biomet Taperloc Short*) and TL (*Tri-Lock J@J*) short-stem endoprostheses. This group included 8 men (36.3%) and 14 women (63.7%). The group of patients with the BTS prosthesis implant was composed of 5 men (35.7%) and 9 women (64.3%). The age of the patients in this group ranged from 47 to 62 years old, giving a mean value of 54 ± 5.1 years. The observation period was from 12 to 18 months.

The group of patients with a TL prosthesis implant comprised 3 men (37.5%) and 5 women (62.5%). The age of the patients in this group ranged from 38 to 56 years old, giving

a mean value of 42 ± 8.7 years. The etiologic cause of the hip osteoarthritis most frequently reported among the patients was idiopathic changes, which were observed in 12 out of them (54.55%), including 8 men and 4 women.

In total, the study comprised 180 patients, including 85 men and 95 women aged from 23 to 62 years old, with a mean value of 44 ± 13.8 years.

All the patients were operated on from a posterolateral portal. In the perioperative period, an anti-inflammatory prophylaxis was used (Tarcefandol, Zinacef, Metronidazole, Fortum), as well as a thromboembolic prophylaxis (Clexane, Fraxiparine) which was applied for a period from 6 to 8 weeks following the date of the surgery. Suction drainage from the post-operative wound to a *Redon* bottle was maintained through the second day. During this period, the patients required transfusions with an average of 2 to 4 units of packed red blood cells (PRBCs) and from 1 to 2 units of fresh frozen plasma (FFP). Upright standing of the patients who underwent surgery took place in the second or third day following the operation, and was preceded by the patients' sitting down on the bed with their legs lowered over its edge and their hips and knees bent. The patients started to learn to walk on the third, fourth or fifth day, initially with the assistance of an orthopaedic walker and then with elbow crutches, without loading the limb operated on. The gradual and controlled loading of the limb operated on began with ground pressure not exceeding 20% of the patient's body mass, which took place three weeks after the implanting of the endoprosthesis into the hip joint. The rehabilitation of all pa-

Table 1

| Research material | | | | | | |
|-----------------------------------|--------|------|--------|------|--------|------|
| Types of hip joint endoprosthesis | Men | | Women | | Total | |
| | number | % | number | % | number | % |
| ABG – 1 (Stryker) | 39 | 21.7 | 57 | 31.7 | 96 | 53.4 |
| Proxima (J@J) | 38 | 21.1 | 24 | 13.3 | 62 | 34.4 |
| BTS (Biomet Taperlic Short) | 5 | 2.7 | 9 | 5 | 14 | 7.7 |
| TL (J@J) | 3 | 1.7 | 5 | 2.8 | 8 | 4.4 |
| Total | 85 | 47.3 | 95 | 52.7 | 180 | 100 |

tients, regardless of the type of prosthesis implanted, was based on the authors' own programme of post-operative rehabilitation, and consisted of four stages: Stage I – the initial phase; Stage II – the movement phase; Stage III – the so-called functional balance phase; and Stage IV – the so-called final rehabilitation phase^{11,12}. This programme is still being applied in the Department of Trauma and Orthopaedic Surgery, 5th Military Clinical Hospital with a Polyclinic in Krakow, Poland, among patients who are undergoing total hip arthroplasty with cementless endoprostheses¹³.

Research method

The research method was based on the performance of the following activities and tests by each of the patients operated on:

1. The physical examination: an examination of the orthopaedic local condition, taking into account the medical history, as well as anteroposterior (AP) radiographs of both hip joints;
2. The functional test of the Harris Hip Scores¹⁴: recorded from 10 to 14 days before the planned surgery and 3, 6 and 12 months after the surgery, performed in patients with the Proxima, BTS and TL endoprostheses implanted. Patients with the ABG-1 endoprosthesis implanted were assessed with the Harris Hip Score from 10 to 14 days before the planned surgery and 12 months after the surgery¹¹. The Harris Hip Score criteria include an evaluation of the objective and subjective indicators. The objective assessment analyses the functional capacity of the hip joint; while the subjective assessment – the pain in the hip joint. The scores are within a point range, corresponding to excellent, good, satisfactory and poor scores (Table 2).

The Harris Hip Score assesses the pain and functionality of the hip joint, including the scope of its mobility and the degree of its disability (Table 3-7).

The assessment of the range of motion in the hip joint is based on the angular values of a single *movement*

arc, which is multiplied by an indicator factor, and the resulting point value is added to the other results of the *movement arcs*. In the overall assessment (Table 8), the result is globally multiplied by 0.05 to get a point value (maximum 5 points).

Statistical analysis methods

The statistical analysis was performed using the Statistica 10 PL software package (Statsoft). In order to pres-

ent the data, elements of descriptive statistics were used (percentage distribution, mean, standard deviation). The data distribution type was

Table 2

| Scale score in Harris Hip Score | |
|---------------------------------|-------------|
| Score | Score range |
| Excellent | 90-100 |
| Good | 80-89 |
| Satisfactory | 70-79 |
| Poor | < 70 |

Table 3

| Point ranges of analysed variables | |
|------------------------------------|-----------|
| Analysed variables | Point sum |
| Pain in the hip joint | 44 |
| Activity in the hip joint | 47 |
| Mobility scope in the hip joint | 5 |
| Absence of disability | 4 |
| Total | 100 |

Table 4

| Pain assessment according to Harris Hip Score (maximum possible value = 44 points) | | |
|--|---|--------|
| Pain type | Pain characteristics | Points |
| No pain | Not applicable | 44 |
| Small pain | Sporadic pain or awareness of the pain of low intensity without any significant impact on the life activities | 40 |
| Mild pain | Rare pain when performing activities different than typical lifestyle activities without any significant impact on them. A patient takes mild painkillers (aspirin) | 30 |
| Moderate pain | Daily occurring pain limiting the life activities but allowing a patient to maintain the ability to work. A patient takes stronger painkillers than aspirin | 20 |
| Considerable pain | Acute pain, occurring daily, clearly limiting the life activities. A patient constantly takes strong painkillers | 10 |
| The pain prevents the joint from moving | Acute pain, forcing a patient to lie down | 0 |

Table 5

| Daily activities assessment according to Harris Hip Score (maximum possible value = 14 points) | | |
|--|---|--------|
| Activity | Activity characteristics | Points |
| Climbing stairs | Climbing stairs without using a handrail | 4 |
| | Climbing stairs using a handrail | 2 |
| | Climbing stairs in a different way | 1 |
| | Unable to climb stairs | 0 |
| Public transport | Able to use public transport | 1 |
| Sitting down | Able to sit in any chair for 1 hour | 5 |
| | Able to sit in a high chair for ½ hour | 3 |
| | Unable to comfortably sit in any chair | 0 |
| Putting on socks and shoes | A patient puts on socks and easily binds shoelaces | 4 |
| | A patient puts on socks and binds shoelaces with difficulty | 2 |
| | A patient is unable to put on socks and bind shoelaces | 0 |

assessed using the Shapiro-Wilk test. In the presence of a normal distribution of the variables, the groups were compared with the Student's *t*-test; whereas in the absence of a normal distribution, the groups were compared with the Mann-Whitney *U* test. The statistically significant level was $p < 0.05$.

RESULTS

Total hip arthroplasty with an ABG-1 endoprosthesis

The scores obtained before the total hip arthroplasty with an ABG-1 endoprosthesis, among men

In the group of men who qualified for the surgery to be analysed due to idiopathic hip osteoarthritis, 17 of them (56.7%) received a satisfactory score, with a mean value of 71 ± 16 points and 13 out of them (43.3%) received poor scores, with a mean value of 52 ± 12 points. In the group of patients with post-traumatic osteoarthritis, satisfactory scores were reported for 5 men (71.4%), with a mean value of 71 ± 11 points, while poor scores were reported for 2 men (28.6%), with a mean value of 50 ± 9 points. One man suffered from developmental dysplasia of the hip joint, and obtained a poor score with a value of 53 points¹¹.

The scores obtained 12 months after the total hip arthroplasty with an ABG-1 endoprosthesis, among men

In the group of men who underwent the total hip arthroplasty with an ABG-1 endoprosthesis due to idiopathic hip osteoarthritis, 24 out of them (80%) received excellent scores, with a mean value of 95 ± 4 points, 4 men (13.3%) received good scores, with a mean value of 83 ± 7 points, and 2 men (6.7%) received satisfactory scores, with a mean value of 71 ± 9 points. In the group of patients with post-traumatic osteoarthritis, excellent scores were reported for 5 men (71.4%), with a mean value of 93 ± 7 points, while good scores were reported for 2 (28.6%), with a mean value of 85 ± 4 points¹¹.

The scores obtained before the total hip arthroplasty with an ABG-1 endoprosthesis, among women

In the group of women who qualified for the total hip arthroplasty with an ABG-1 endoprosthesis due to idiopathic hip osteoarthritis, based on the Harris Hip Score criteria, satisfactory scores were reported for 12 of them (35.2%), with a mean val-

ue of 73 ± 11 points, while poor results were reported for 22 patients (64.8%), with a mean value of 46 ± 15 points. In the group of women who qualified for the surgery due to hip osteoarthritis in the course of congenital hip dysplasia, satisfactory scores were reported for 9 women (56.3%), with a mean value of 72 ± 6 points, whereas poor results were reported for 7 women (43.7%), with a mean val-

Table 6

| Gait efficiency assessment according to Harris Hip Score (maximal possible value = 33 points) | |
|--|---------------|
| Gait efficiency – limping | Points |
| Walk with limping | 11 |
| Walk with slight limping | 8 |
| Walk with moderate limping | 5 |
| Walk with clear limping | 0 |
| Walk without a walking stick or elbow crutch | 11 |
| Walk with assistance of a walking stick or elbow crutch for a long stroll | 7 |
| Walk with assistance of a walking stick for most of the day | 5 |
| Walk with assistance of an elbow crutch for most of the day | 3 |
| Walk with assistance of two sticks | 2 |
| Walk with assistance of two elbow crutches | 0 |
| The total inability to walk | 0 |

Tabela 7

| Distance walked according to Harris Hip Score | |
|--|---------------|
| Distance covered | Points |
| Unlimited distance | 11 |
| Distance possible to cover is about 600-1000 meters | 8 |
| Distance possible to cover is about 200-400 meters | 5 |
| Walking only around home | 2 |
| Sitting on a chair and lying in a bed | 0 |

Tabela 8

| Range of hip joint motion according to Harris Hip Score (maximal possible value = 5 points) | | | | |
|--|---------------------|---------------------|-------------------------|---------------|
| Motion | Motion range | Movement arc | Indicator factor | Points |
| Flexion | 0-45° | 45° | 1.0 | 45 |
| | 46-90° | 45° | 0.6 | 27 |
| | 91-110° | 20° | 0.3 | 6 |
| | 111-130° | 20° | 0.0 | 0 |
| Abduction | 0-15° | 15° | 0.8 | 12 |
| | 16-20° | 5° | 0.3 | 15 |
| | 21-45° | 25° | 0.0 | 0 |
| External rotation | 0-15° | 15° | 0.4 | 6 |
| | > 15° | Not applicable | 0.0 | 0 |
| Internal rotation | Not applicable | | Not applicable | 0 |
| Adduction | 0-15° | 15° | 0.2 | 3 |
| | > 15° | Not applicable | 0.0 | 0 |

ue of 47 ± 18 points. Among the patients with post-traumatic hip osteoarthritis before the surgery, according to the Harris Hip Score, one woman obtained a satisfactory score and one woman – a poor score (which represents 50%). Among the women with post-inflammatory hip osteoarthritis, both patients received poor scores (100%).

The scores obtained 12 months after the total hip arthroplasty with an ABG-1 endoprosthesis, among women

According to the Harris Hip Score criteria, in the group of women with idiopathic hip osteoarthritis, 26 of them (76.5%) received excellent scores, with a mean value of 95 ± 5 points, 6 out of them (17.6%) received good scores, with a mean value of 84 ± 7 points, and 2 women (5.9%) received satisfactory scores, with a mean value of 72 ± 9 points. In the group of women with hip osteoarthritis in the course of congenital hip dysplasia, excellent scores were recorded for 10 of them (62.5%), with a mean value of 91 ± 6 points, good scores for 4 women (25%), with a mean value of 83 ± 10 points, and satisfactory scores for 2 patients (12.5%), with a mean value of 72 ± 8 points. In the group of women with post-traumatic hip osteoarthritis who had an ABG-1 endoprosthesis implanted, excellent scores were reported for 2 women (100%), with a mean value of 93 ± 2 points. Among the women with post-inflammatory hip osteoarthritis, one patient (50%) received a good score, with a value of 83 points, while the other (50%) received a satisfactory score, with a value of 71 points.

Total hip arthroplasty with a Proxima endoprosthesis

The scores obtained by men who qualified for a total hip arthroplasty with a Proxima endoprosthesis, depending on the etiology of the osteoarthritis

According to the Harris Hip Score criteria, in the group of men qualified for a total hip arthroplasty with a Proxima metaphyseal-fitting endo-

prosthesis due to idiopathic hip osteoarthritis, satisfactory scores were recorded for 32 of them (84.2%), with a mean value of 74 ± 12 points, while poor scores were recorded for 5 men (13.2%), with a mean value of 67 ± 13 points. One man (2.6%) diagnosed with post-traumatic hip osteoarthritis obtained a poor score, with a value of 65 ± 11 points.

The scores obtained by men 3 months after the total hip arthroplasty with a Proxima endoprosthesis, depending on the etiology of the osteoarthritis

In the group of men 3 months after the total hip arthroplasty with a Proxima metaphyseal-fitting endoprosthesis due to idiopathic hip osteoarthritis, excellent scores were reported for 3 of them (7.9%), with a mean value of 91 ± 4 points, good scores were recorded for 29 (76.3 %), with a mean value of 84 ± 8 points, and satisfactory scores were recorded for the remaining 5 men (13.2%) with a mean value of 77 ± 5 points. One man (2.6%) who underwent the analysed surgery due to post-traumatic hip osteoarthritis received a good score, with a value of 85 points.

The scores obtained by men 6 months after the total hip arthroplasty with a Proxima endoprosthesis, depending on the etiology of the osteoarthritis

In the group of men 6 months after the total hip arthroplasty with a Proxima metaphyseal-fitting endoprosthesis due to idiopathic hip osteoarthritis, excellent scores were reported for

11 of them (29%), with a mean value of 93 ± 4 points, good scores were recorded for 23 men (60.5%), with a mean value of 85 ± 7 points, and satisfactory scores were recorded for the remaining 3 patients (7.9%), with a mean value of 77 ± 5 points. One man (2.6%) who underwent the analysed surgery due to post-traumatic hip osteoarthritis received a good score, with a value of 85 points.

The scores obtained by men 12 months after the total hip arthroplasty with a Proxima endoprosthesis, depending on the etiology of the osteoarthritis

In the group of men 12 months after the total hip arthroplasty with a Proxima metaphyseal-fitting endoprosthesis due to idiopathic hip osteoarthritis, excellent scores were reported for 19 of them (50%), with a mean value of 95 ± 5 points, good scores were recorded for 17 men (44.8%), with a mean value of 85 ± 11 points, and a satisfactory score was recorded for one patient (2.6%), with a value of 73 points. One man (2.6%) who underwent the analysed surgery due to post-traumatic hip osteoarthritis received a good score, with a value of 86 points.

The scores obtained by women who qualified for total hip arthroplasty with a Proxima endoprosthesis, depending on the etiology of the osteoarthritis

According to the Harris Hip Score criteria, in the group of women who qualified for a total hip arthroplasty with a Proxima metaphyseal-fit-

Tabela 9

| Absence of deformity according to Harris Hip Score14 (maximal possible value = 4 points) | | |
|---|----------------------------------|---------------|
| Analysed variable | The degree of contracture | Points |
| Flexion contracture | < 30o | 1 |
| | > 30o | 0 |
| Fixed adduction | < 10o | 1 |
| | > 10o | 0 |
| Fixed internal rotation | < 10o | 1 |
| | > 10o | 0 |
| The difference in leg length | < 3.2 cm | 1 |
| | > 3.2 cm | 0 |

ting endoprosthesis due to idiopathic hip osteoarthritis, satisfactory scores were recorded for 9 of them (37.5%), with a mean value of 71 ± 14 points, while poor scores were recorded for 7 women (29.2%), with a mean value of 63 ± 12 points. In the group of women diagnosed with hip osteoarthritis due to developmental dysplasia, satisfactory scores were recorded for 2 of them (8.3%), with a mean value of 73 ± 6 points, whereas poor scores were recorded for the remaining 6 women (25%), with a mean value of 61 ± 10 points.

The scores obtained by women 3 months after the total hip arthroplasty with a Proxima endoprosthesis, depending on the etiology of the osteoarthritis

In the group of women 3 months after the total hip arthroplasty with a Proxima metaphyseal-fitting endoprosthesis due to idiopathic hip osteoarthritis, excellent scores were reported for one of them (4.2%), with a mean value of 92 points, good scores were recorded for 12 women (50.0%), with a mean value of 84 ± 7 points, and satisfactory scores were recorded for the remaining 3 patients (12.5%), with a mean value of 76 ± 9 points. Among the women who underwent the analysed surgery due to hip osteoarthritis in the course of developmental dysplasia, one patient (4.2%) received an excellent score, with a value of 93 points, 5 women (20.7%) received good scores, with a mean value of 84 ± 5 points, and the remaining 2 patients (8.4%) obtained satisfactory scores, with a mean value of 75 ± 11 points.

The scores obtained by women 6 months after the total hip arthroplasty with a Proxima endoprosthesis, depending on the etiology of the osteoarthritis

In the group of women 6 months after the total hip arthroplasty with a Proxima metaphyseal-fitting endoprosthesis due to idiopathic hip osteoarthritis, excellent scores were reported for 8 of them (33.3%), with a mean value of 94 ± 3 points, good scores were recorded for 6 women

(25.0%), with a mean value of 86 ± 7 points, and satisfactory scores were recorded for the remaining 2 patients (8.4%), with a mean value of 76 ± 4 points. Among the women who underwent the analysed surgery due to hip osteoarthritis in the course of developmental dysplasia, 3 patients (12.5%) received excellent scores, with a mean value of 93 ± 2 points, while 5 women (20.8%) obtained good scores, with a mean value of 86 ± 7 points.

The scores obtained by women 12 months after the total hip arthroplasty with a Proxima endoprosthesis, depending on the etiology of the osteoarthritis

In the group of women 12 months after the total hip arthroplasty with a Proxima metaphyseal-fitting endoprosthesis due to idiopathic hip osteoarthritis, excellent scores were reported for 11 out of them (45.8%), with a mean value of 93 ± 6 points, good scores were recorded for 4 women (16.7%), with a mean value of 86 ± 4 points, and a satisfactory score was recorded for one patient (4.2%), who obtained 71 points. Among the women who underwent the analysed surgery due to hip osteoarthritis in the course of developmental dysplasia, excellent scores were recorded for 3 patients (12.5%), with a mean value of 93 ± 2 points, while good scores were recorded for the remaining 5 women (20.8%), with a mean value of 86 ± 6 points.

Total hip arthroplasty with a BTS endoprosthesis

The scores obtained by men who qualified for the total hip arthroplasty with a BTS endoprosthesis due to the idiopathic hip osteoarthritis

In the group of men who qualified for the implantation of a BTS endoprosthesis into the hip joint due to idiopathic hip osteoarthritis, satisfactory scores were reported for 4 of them (80%), with a mean value of 72 ± 10 points, and a poor score for one men (20%), who received 64 points.

The scores obtained by men 3 months after the total hip arthroplasty with a BTS endoprosthesis due to the idiopathic hip osteoarthritis

In this group of patients, an excellent score was reported for one man (20%), with 92 points, good scores for 3 men (60%), with a mean value of 84 ± 6 points, and a satisfactory score for one man (20%), with 74 points.

The scores obtained by men 6 months after the total hip arthroplasty with a BTS endoprosthesis due to the idiopathic hip osteoarthritis

In this group of patients, an excellent score was reported for one man (20%), who received 94 points, good scores for 3 men (60%), with a mean value of 86 ± 5 points, and a satisfactory score for one man (20%), who obtained 76 points.

The scores obtained by men 12 months after the total hip arthroplasty with a BTS endoprosthesis due to the idiopathic hip osteoarthritis

In this group of patients, excellent scores were reported for 3 men (60%), with a mean value of 96 ± 3 points, a good score for one man (20%), who obtained 88 points, and a satisfactory score for one man (20%), who got 76 points.

The scores obtained by women who qualified for the total hip arthroplasty with a BTS endoprosthesis depending on the etiology of osteoarthritis

Among the women suffering from idiopathic hip osteoarthritis, a satisfactory score was recorded for one patient (11.1%), who gained 70 points, and a poor score was recorded for one patient (11.1%), who scored 64 points. In the group of women with hip osteoarthritis due to congenital hip dysplasia, satisfactory scores were reported for 2 patients (22.2%) with a mean value of 73 ± 10 points, whereas poor scores were recorded for 5 women (55.6%), with a mean value of 61 ± 13 points.

The scores obtained by women 3 months after the total hip arthroplasty with the BTS endoprosthesis, depending on the etiology of the osteoarthritis

In the group of women with idiopathic hip osteoarthritis in the analysed period, a good score was recorded for one patient (11.1%), with a value of 82 points, and a satisfactory score was recorded for one patient (11.1%), who received 74 points. In the group of women with hip osteoarthritis due to congenital hip dysplasia, an excellent score was reported for 1 of the women (11.1%), with 92 points, good scores for 5 of them (55.6%), with a mean value of 82 ± 7 points, while a satisfactory score was obtained by 1 patient (11.1%), who received 75 points.

The scores obtained by women 6 months after the total hip arthroplasty with a BTS endoprosthesis, depending on the etiology of the osteoarthritis

In the group of women with idiopathic hip osteoarthritis, an excellent score was recorded for one patient (11.1%), who got 94 points, and a good score was recorded for one patient (11.1%), with 84 points. In the group of women with hip osteoarthritis due to developmental dysplasia, excellent scores were reported for 4 women (44.4%), with a mean value of 94 ± 3 points, good scores for 2 women (22.2%), with a mean value of 86 ± 2 points, while a poor score was recorded for 1 patient (11.1%), who received 74 points.

The scores obtained by women 12 months after the total hip arthroplasty with a BTS endoprosthesis, depending on the etiology of the osteoarthritis

In the group of patients with idiopathic hip osteoarthritis, excellent scores were recorded for two women (22.2%), with a mean value of 94 ± 4 points. In the case of women with hip osteoarthritis due to the developmental dysplasia, excellent scores were reported for 5 patients (55.5%), with a mean value of 94 ± 3 points, a good score for 1 woman (11.1%),

who obtained 86 points, while a satisfactory score was also recorded for 1 patient (11.1%), who obtained 78 points.

Total hip arthroplasty with a TL endoprosthesis

The scores obtained by men who qualified for the total hip arthroplasty with a TL endoprosthesis due to the idiopathic hip osteoarthritis

In this group of patients suffering from idiopathic hip osteoarthritis, satisfactory scores were recorded for 2 patients (66.7%), with a mean value of 74 ± 8 points, while a poor score was recorded for 1 patient (33.3%), who obtained 66 points.

The scores obtained by men 3 months after the total hip arthroplasty with a TL endoprosthesis due to idiopathic hip osteoarthritis

An excellent score was reported for one man (33.3%), who received 92 points, a good score was also recorded for one man (33.3%), who obtained 82 points, and a satisfactory score was recorded for one man (33.3%), who obtained 74 points.

The scores obtained by men 6 months after the total hip arthroplasty with a TL endoprosthesis due to idiopathic hip osteoarthritis

In this group of patients, an excellent score was reported for one man (33.3%), a good score was also recorded for one man (33.3%), as well as a satisfactory score for one man (33.3%).

The scores obtained by men 12 months after the total hip arthroplasty with a TL endoprosthesis due to idiopathic hip osteoarthritis

In this group, excellent scores were reported for two men (66.7%), with a mean value of 96 ± 1 points; whereas a good score was reported for one man (33.3%), who received 76 points.

The scores obtained by women who qualified for the total hip arthroplasty with a TL endoprosthesis, depending on the etiology of the osteoarthritis

Among the women suffering from idiopathic hip osteoarthritis, a satisfactory score was recorded for one patient (20%), who obtained 70 points, and a poor score was also recorded for one patient (20%), who received 62 points. In the group of women with hip osteoarthritis due to developmental dysplasia, a satisfactory score was reported for 1 patient (20%), with a value of 73 points, whereas poor scores were recorded for 2 women (40%), with a mean value of 64 points.

The scores obtained by women 3 months after the total hip arthroplasty with a TL endoprosthesis, depending on the etiology of the osteoarthritis

In the group of patients suffering from idiopathic hip osteoarthritis in the analysed period, a good score was recorded for 1 patient (20%), who received 80 points, and a poor score for 1 patient (20%), who obtained 74 points. In the case of women with hip osteoarthritis due to developmental dysplasia, an excellent score was reported for 1 patient (20%), with a value of 92 points, while good scores were reported for 2 women (40%), with a value of 82 points.

The scores obtained by women 6 months after the total hip arthroplasty with a TL endoprosthesis, depending on the etiology of the osteoarthritis

Among the women suffering from idiopathic hip osteoarthritis, an excellent score was recorded for one patient (20%), who obtained 94 points, and a good score was also recorded for one patient (20%), who obtained 84 points. In the case of hip osteoarthritis due to developmental dysplasia, excellent scores were reported for 2 women (40%), with a mean value of 94 ± 2 points, whereas a good score was recorded for 1 woman (20%), who received 86 points.

The scores obtained by women 12 months after the total hip arthroplasty with a TL endoprosthesis, depending on the etiology of the osteoarthritis

In the case of idiopathic hip osteoarthritis, an excellent score was recorded for one patient (20%), who obtained 94 points, and a good score was also recorded for one patient (20%), who obtained 86 points. In the case of hip osteoarthritis due to developmental dysplasia, excellent scores were reported for 2 women (40%), with a mean value of 94 ± 4 points, whereas a satisfactory score was recorded for 1 woman (20%), who received 86 points.

The results of the statistical analysis

In the case of the ABG-1 endoprosthesis, there was a significant increase ($p < 0.01$) in the Harris Hip Score within the 12-month follow-up period for both men and women, regardless of the hip osteoarthritis etiology.

In the case of the Proxima endoprosthesis, the preoperative Harris Hip Score did not differ significantly ($p > 0.05$) in men and women with the idiopathic etiology of the hip osteoarthritis. A statistically significant increase ($p < 0.001$) in the Harris Hip Score was seen as early as 3 months after the surgery, both in men and in women. This increase was also maintained at the 6-month follow-up ($p < 0.01$ for both men and women, compared with the 3-month follow-up) and after a period of 12 months, both in men ($p < 0.05$ compared with the evaluation after 6 months and $p < 0.001$ compared with the preoperative assessment) and women ($p < 0.05$ compared with the evaluation after 6 months and $p < 0.001$ compared with the preoperative assessment).

There were no statistically significant differences ($p > 0.05$) in the Harris Hip Score between the groups of men and women with the ABG-1 and the Proxima endoprostheses at the 12-month follow-up.

The statistical analysis of the scores did not include patients with the implanted BTS and TL endoprostheses,

due to an insufficient number of patients within the groups.

DISCUSSION

The problems for the surgical treatment of advanced degenerative changes in the hip joint or for femoral neck fractures, including the selection of a suitable implant, as well as the effectiveness of the rehabilitation programmes for the patients operated on, seems to be a constant matter of interest for different environments, as well as being associated with medical studies in a broader sense^{1,7,15,16}. The dynamic development of methods over the past several years has mainly been connected with searching for and introducing into surgical practices increasingly modern implants, the use of which is believed to, among other things: prolong their "technological life"; minimise the operation-caused damage resulting from the extent of the portal to the pathologically changed hip joint, with favourable and minimally invasive surgical techniques; and reducing or excluding any operational errors, which may provoke various kinds of local and systemic complications, enabling the possibility of the early upright standing of the patients operated on and their safe rehabilitation, and, in this context, a clear improvement to their quality of life^{3,5,10,17}. Certainly, such implants include metaphyseal-fitting, short-stem and cementless endoprostheses with a standard stem^{2-4,6}. It also appears that, assuming the correct technical execution of the analysed surgical procedures, a key factor in their efficiency is the patients' post-operative rehabilitation care. A number of important and necessary elements must be taken into account to restore the patients' lost motor functions and ability to serve themselves, to eliminate existing contractures and movement disabilities of the operated joint and others, as well as to undertake tasks associated with gait re-education and its aesthetics^{7,8,11-13}. Undoubtedly, the radiological result of the presented hip arthroplasties is an important element for the whole treatment process. These results have a measurable reference and are reflected in

the nature of functional scores, which seem to be crucial in the assessment of the patients themselves. In connection with this position, the functional scores of total hip arthroplasties with the cementless metaphyseal-fitting and short-stem endoprostheses were assessed in the authors' own material, comparing them with the functional scores of total hip arthroplasties with cementless endoprostheses with a standard stem in early and late observation periods^{11,12}. From this perspective, the crucial question seems to be whether or not the presented hip arthroplasties require rehabilitation programmes with different biomechanical and clinical characteristics. The assessment was based on the patients' Harris Hip Score¹⁴.

An evaluation of the functional effectiveness of the implantation of ABG-1 cementless endoprostheses with a standard stem in the years from 1993 to 1999, performed in our clinic on 96 patients, confirmed the applicability of our method, regardless of the etiology of the osteoarthritis of the operated joints and the efficiency of the press-fit technique. Similar functional scores were observed in 62 patients treated with a total hip arthroplasty with a Proxima cementless metaphyseal-fitting endoprosthesis. Such observations have been shared by, among others, Tomaszewski et al.⁵, who reported good results following an Proxima endoprosthesis implantation, but even more favourable results with respect to the ABG endoprosthesis with a standard stem. Snyder et al.¹⁸ draws attention to a more difficult surgical technique of implanting a Metha short stem mandrel, which is consistent with the authors' own observations in relation to the Proxima endoprosthesis and requires special attention from surgeons and specific anatomical conditions of the stump of the proximal end of the femur. This does not change the fact that the functional scores for this type of endoprostheses implanted into the hip joint are good, and encourages further observations and analysis. We did not see any crucial and clear differences in the nature of the functional scores, either in the early nor the late observation periods, in patients who

had BTS cementless endoprostheses with a short stem implanted (in the number of 14) and TL endoprostheses implanted (in the number of 8), when compared to the endoprostheses with a standard stem. The presented observations, based on a group of 180 patients who underwent operations in the years from 1993 to 2014, leads us to the opinion that the total hip arthroplasty with cementless endoprostheses with a standard stem, as well as the metaphyseal-fitting endoprostheses and the endoprostheses with a short stem, result in good and comparable functional scores. Therefore, a statement suggesting that the discussed surgical procedures do not require different rehabilitation programmes with clearly distinct biomechanical and clinical characteristics is justified in this context.

CONCLUSIONS

1. Total hip arthroplasty with metaphyseal-fitting and short stem endoprostheses resulted in excellent and good functional scores for the majority of patients, both in the early and the late observation periods, with a slight advantage in patients with idiopathic osteoarthritis.
2. The functional scores for total hip arthroplasty with metaphyseal-fitting and short stem endoprostheses, both in the early and the late observation periods, were comparable with the scores of total hip arthroplasty with standard stem endoprostheses.
3. Patients undergoing operations for hip osteoarthritis using total hip arthroplasty with metaphyseal-fitting and short stem endoprosthe-

ses do not require rehabilitation programmes with different biomechanical and clinical characteristics, when compared to those patients treated with total hip arthroplasty and with standard stem cementless endoprostheses.

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Address for correspondence

Dr n. med. Krzysztof Tomaszewski
Klinika Chirurgii Urazowej i Ortopedii
5 Wojskowego Szpitala Klinicznego z Polikliniką
Samodzielny Publiczny Zakład Opieki Zdrowotnej
w Krakowie
ul. Wrocławska 1-3, 30-901 Kraków, Poland
tel. +48 12-63-08-206
e-mail: krtomaszewski@gmail.com