

Can a cementless partial hip prosthesis be preferred in patients with hip fractures when the Spotorno score is greater than 5?

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ABSTRACT

Aims: Partial hip arthroplasty is preferred in elderly patients with low activity levels, numerous comorbidities, and limited mobility for hip fractures. To decide whether to use cement in femoral stem implantation, scoring systems such as Spotorno, Dorr, and Canale Flare Indices are used. Generally, cemented application is frequently for patients with over 5 points according to Spotorno criteria. In this study, our aim is to present the outcomes of patients who had a score of 5 or more according to the Spotorno criteria and required cemented prostheses but instead received cementless partial hip prostheses.

Methods: Patients who underwent partial hip arthroplasty due to post-traumatic femoral neck fractures in our hospital's orthopedics and traumatology clinic between 2017 and 2021 were retrospectively evaluated. To calculate the total score according to the Spotorno criteria, which evaluate age, sex, Singh index and morphological cortical index, the radiographs of the patients included in the study were assessed, and the Singh index and morphological cortical index (MCI) were calculated. Periprosthetic fractures, prosthesis dislocations, heterotopic ossification, femoral loosening and mortality had been recorded. A total of 192 patients over the age of 70 with ASA III and ASA IV who underwent cementless partial hip arthroplasty were included in the study. Among these patients, 126 were female (% 5.7) and 66 were male (%34.3). Mean follow up was 5.8 years (0-7 years).

Results: According to the Spotorno criteria, the total score for all patients was greater than 6. Periprosthetic fractures were detected in % 3.1. Heterotopic ossification was observed in %9.3. In the postoperative 1st month, mortality was observed in %5.

Conclusion: Cementless hip arthroplasty in elderly patients with a Spotorno score of 5 or higher can be as effective and applicable as cemented hip arthroplasty. Although the literature generally recommends cemented hip prostheses for such patients, cementless partial hip arthroplasty can be a viable option if standard latest-generation cementing systems are not available.

Keywords: Spotorno criteria, cementless partial hip arthroplasty, elderly patients

INTRODUCTION

Femoral neck fractures, which account for approximately 50% of hip fractures, are a significant health issue in elderly patients. The increasing lifespan, the desire for individuals to meet their own needs, a more active lifestyle, and various comorbidities, particularly osteoporosis, are causing the number of hip fracture patients in the elderly population to rise rapidly.^{1,2} Globally, the number of hip fracture cases is projected to reach 6.26 million per year by 2050.³ In this respect, hip fractures are not only an important health issue but also a significant public health problem with social and economic implications.^{4,5}

The primary goals in the treatment of a patient with a hip fracture are pain relief, early mobilization, returning the patient to their pre-fracture functional level, and avoiding potentially fatal complications.

The patient's physiological age, activity level, bone quality, and comorbidities are crucial in determining the treatment option.⁶⁻⁸ Partial hip arthroplasty is preferred in elderly

patients with low activity levels, numerous comorbidities, and limited mobility.^{1,9,10}

Femoral stem implantation can be performed with or without cement. To decide whether to use cement in femoral stem implantation, scoring systems such as Spotorno, Dorr, and Canale Flare Indices are used.¹¹ Generally, cemented application is frequently preferred in elderly patients with poor bone quality due to less thigh pain and a lower risk of periprosthetic fractures. However, the pressurized application of cement increases intramedullary pressure and can cause fat embolism and potentially fatal bone cement implantation syndrome, especially in patients with various comorbidities.¹²

In this study, our aim is to present the outcomes of patients who had a score of 5 or more according to the Spotorno criteria and required cemented prostheses but instead received cementless partial hip prostheses in ASA (American Society of Anesthesiologists) III and ASA IV patients. As far as we have reviewed in the literature, this study is the first to report

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the outcomes of cementless partial hip prostheses in patients who scored 5 or more according to the Spotorno criteria.

METHODS

Our study received approval from the Giresun Training and Research Hospital Ethics Committee (Date: 17.07.2024, Decision No: 249120767). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Patients who underwent partial hip arthroplasty due to post-traumatic femoral neck fractures in our hospital's Orthopedics and Traumatology Clinic between 2017 and 2021 were retrospectively evaluated. By reviewing the patients' medical records, information on their sex, age, ASA (American Society of Anesthesiologists) classification, and comorbidities was obtained. To calculate the total score according to the Spotorno criteria, which evaluate age, sex, Singh index, and Morphological Cortical Index (MCI), the radiographs of the patients included in the study were assessed. The Singh index and MCI were calculated. Incidents of periprosthetic fractures, prosthesis dislocations, heterotopic ossification, femoral loosening, and mortality were recorded. A retrospective evaluation was conducted on 248 patients with femoral neck fractures. Patients with a Spotorno score of less than 5, those under 65 years of age, those who underwent total hip arthroplasty, and those classified as ASA I and ASA II were excluded from the study. A total of 192 patients over the age of 70 with ASA III and ASA IV who underwent cementless partial hip arthroplasty were included in the study. Among these patients, 126 were female (% 65.7) and 66 were male (% 34.3) (Table 1 and 2). Mean follow up was 5.8 years (0-7 years).

Table 1. Spotorno criteria sex

| Sex | Point | n | % |
|--------|-------|-----|------|
| Female | 1 | 126 | 65.7 |
| Male | 0 | 66 | 34.3 |

Table 2. According to Spotorno age

| Age (years) | Point | n | % |
|-------------|-------|-----|-----|
| <50 | 0 | 0 | 0 |
| 51-60 | 1 | 0 | 0 |
| 61-70 | 2 | 0 | 0 |
| >70 | 4 | 192 | 100 |

Although Spotorno, Dorr, and Canale Flare Indices scoring systems are used to decide whether to apply cement in femoral stem implantation, Kacmaz¹¹ and colleagues found the highest interobserver agreement using the Spotorno criteria. Therefore, in our study, patients were evaluated according to the Spotorno criteria.

To calculate the total score according to the Spotorno criteria, which evaluate age, gender, Singh index, and morphological cortical index, the radiographs of the patients included in the study were assessed, and the Singh index and morphological cortical index (MCI) were calculated.

Periprosthetic fractures, prosthesis dislocations, heterotopic ossification, and femoral loosening that could be detected radiographically were recorded. Mortality tracking for the patients was conducted through the Turkish Ministry of Health's online patient follow-up system. All patients were discharged after being mobilized. Periprosthetic fractures, prosthesis dislocations, heterotopic ossification, femoral loosening and mortality had been recorded.

RESULTS

Regarding the Singh index, 36 patients (18.75%) had a score of 5-6, 108 patients (56.25%) had a score of 3-4, and 48 patients (25%) had a score of 1-2 (Table 3). When evaluated according to the Morphological Cortical Index (MCI), 12 patients (6.25%) had an MCI greater than 3, 36 patients (18.75%) had an MCI between 2.7 and 3, 66 patients (34.37%) had an MCI between 2.3 and 2.6, and 78 patients (40.63%) had an MCI less than 2.3 (Table 4). According to the Spotorno criteria, the total score for all patients was greater than 6 (Table 5).

Table 3. According to Spotorno singh index

| Singh index | Point | n | % |
|-------------|-------|-----|-------|
| 7 | 0 | 0 | 0 |
| 5-6 | 1 | 36 | 18.75 |
| 3-4 | 2 | 108 | 56.25 |
| 1-2 | 4 | 48 | 25 |

Table 4. According to Spotorno MCI

| MCI | Point | n | % |
|---------|-------|----|-------|
| >3 | 0 | 12 | 6.25 |
| 2.7-3 | 1 | 36 | 18.75 |
| 2.3-2.6 | 2 | 66 | 34.37 |
| <2.3 | 4 | 78 | 40.63 |

MCI: Morphological cortical index

Table 5. Total Spotorno score

| Spotorno score | Cemented/cementless | n | % |
|----------------|------------------------|-----|-----|
| 0-4 | Cementless | 0 | 0 |
| 5 | Cemented or cementless | 0 | 0 |
| 6 | Cemented | 192 | 100 |

Periprosthetic fractures were detected in 6 patients (3.1%). In 4 (2%) patients, a cable was observed in the subtrochanteric region on the postoperative day 1 X-ray. The operation note confirmed that iatrogenic fractures occurred in these 2% (4 patients) patients. Heterotopic ossification was observed in 18 patients (9.3%), with 12 patients showing Brooker type 1 myositis and 6 patients showing Brooker type 2 myositis. Femoral stem loosening was detected in 4% (8 patients) of patients. During the postoperative hospital stay, no mortality was observed. However, in the postoperative 1st month, mortality was observed in 5% (11 patients) according to the Ministry of Health's online patient follow-up system.

DISCUSSION

The most important finding of this study is that the outcomes of cementless partial hip arthroplasty in patients who, according to the Spotorno criteria, are indicated for cemented hip prostheses are similar to those reported for cemented partial hip prostheses in the literature. There is no difference in terms of mobilization, periprosthetic fractures, iatrogenic fractures, femoral stem loosening, and early mortality between cementless and cemented partial hip arthroplasty in the literature.

In elderly patients, partial hip arthroplasty is preferred for the treatment of displaced femoral neck fractures. However, the choice of whether to use cemented or cementless partial hip arthroplasty remains a topic of discussion. Cemented hip prostheses have the advantage of lower risks of periprosthetic fractures and thigh pain compared to cementless prostheses. However, the pressurization of cement increases intramedullary pressure and can lead to fat embolism and potentially fatal bone cement implantation syndrome, particularly in patients with various comorbidities.¹³ Cementless implantation provides lower intramedullary pressure with reduced embolization and hemodynamic instability, resulting in lower mortality.¹⁴ For patients scoring 5 or higher according to the Spotorno criteria, cemented hip prostheses are recommended due to poor bone quality. It has been demonstrated in the literature that advancements in cementing techniques over time have extended the lifespan of prostheses.¹⁵ Although the articles in the literature do not specify which generation of cementing system is used in cemented partial hip arthroplasties, we assume the most recent generation is employed. Due to cost constraints, social security policies in our country do not cover the latest cementing systems. Therefore, in patients who were indicated for cemented partial hip arthroplasty, we were forced to use cementless partial hip arthroplasty systems. This situation has provided us with a substantial pool of information regarding cementless partial hip prostheses for patients with such bone quality.

In patients over 70 years old with ASA III and ASA IV who have severe systemic diseases, cardiopulmonary functions and physical activities are significantly reduced. Many studies have reported that bone cement can increase mortality by triggering cerebrovascular complications and cardiovascular events.¹⁶⁻¹⁹ In our study, although all patients were followed for at least 2 years, the average hospital stay for the patients included in the study was 7.3 days (range 4-21). During the hospital stay, no patients who resulted in mortality were observed.

The effect of cement application on mortality in partial hip prostheses is a debated topic in the literature. In their meta-analysis, Wu et al.²⁰ found no significant difference in 6-week mortality rates between cemented and uncemented partial hip arthroplasties. Taylor et al.²¹ reported a mortality rate of 12.5% in both cemented hemiarthroplasties and cementless hemiarthroplasties during the first 6 weeks postoperatively. Grammatopoulos et al.²² found 30 day mortality as 8.6 and 11.7 in cemented and cementless hemiarthroplasties respectively. In our study, mortality was observed in 5% of the patients in the postoperative 1st month. Our findings are comparable to those in the literature.

The incidence of periprosthetic fractures following cementless partial hip arthroplasty has been reported to range from 5.5% to 15%.^{12,23} Another study found this rate to be 2.1%, attributing the decrease in periprosthetic fracture incidence to the increased experience with cementless implantation techniques. Ng et al.²³ reported an incidence of intraoperative femoral fractures of 1%, while Rajak et al.²⁴ reported 1.9%. In our study, periprosthetic fractures were observed in 3.1% and intraoperative femoral fractures in 2% of the patients, which are consistent with the literature.

In their meta-analysis, Elmenshavy et al.²⁵ reported that the risk of dislocation and heterotopic ossification is lower in cementless partial hip arthroplasties, while the risk of intraoperative femoral fractures is higher in the cementless group, although this difference is not statistically significant. In our study heterotopic ossification was observed in 9.3% of the patients which is consistent with the literature.

Limitations

This study has several limitations. Firstly, due to being a hospital dependent on social security institutions, we could not create a control group using third generation cementing techniques as this would have imposed an additional economic burden on the patients. Another significant limitation is the lack of objective criteria for assessing the patients' quality of life in the long term. On the other hand, one of the strengths of our study is that a large portion of our results is based on official data from the Ministry of Health.

CONCLUSION

Cementless hip arthroplasty in elderly patients with a Spotorno score of 5 or higher can be as effective and applicable as cemented hip arthroplasty. Although the literature generally recommends cemented hip prostheses for such patients, cementless partial hip arthroplasty can be a viable option if standard latest generation cementing systems are not available.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Giresun Training and Research Hospital Ethics Committee (Date: 17.07.2024, Decision No: 249120767).

Informed Consent

All institutional and national guidelines for the care and use of laboratory animals were followed.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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