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Different Types of Hip Endoprostheses after Osteoporotic Femoral Neck Fracture; Functional Results?

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Abstract

Aim of this study was to recognize differences in long-term clinical outcome after femoral neck fracture and hip endoprosthesis implantation.

Total of 145 patients were examined, 32 patients with unipolar, 70 with bipolar and 43 patients with total hip endoprosthesis.

The mean values of Harris hip score, after 3.8 ± 1.9 years, were: 72.1 ± 17.8 , 74.27 ± 19.1 , 78.2 ± 22.5 for patients with unipolar, bipolar and total hip endoprosthesis, respectively. No statistically significant difference was observed ($p=0.704$). The in-hospital mortality rates were: 4.3%, 4.6%, and 5.3% for groups of patients with bipolar, unipolar and total hip endoprosthesis, respectively.

Considering clinical outcomes, general health and costs, it could be concluded that choice of endoprosthesis does not pose an obstacle in patient's recovery.

Keywords: Hip; Fracture; Endoprosthesis; Result; Function

Introduction

Consequences of aging on the hip joint (osteoporosis, variation of the femoral neck), as well as reduction of psycho-physical abilities of a patient (neuromuscular incoordination, fear from activities) and comorbidities predispose elderly to the hip joint fracture. Cumulative risk was shown to be for women 18% and for men 6% [1]. Approximately 30% of bed capacity in surgical facilities is occupied by patients with this sort of injury [2]. The cost of treatment for patients with the hip fracture in the U.S. is exceeding \$ 8.7 billions per year, and an assessment is that it would exceed 16 billions by the year 2040 [3].

For all given reasons, a choice for the most rational treatment carries medical and economic importance for both patient and society. However, opinions about type of endoprosthesis that should be implanted after femoral neck fracture differ from one author to another. Some authors prefer implantation of unipolar partial hip endoprosthesis while others prefer bipolar partial endoprosthesis after displaced femoral neck fracture in elderly persons [4-19]. Total hip endoprostheses, according to majority, achieve the best long-term clinical outcome. But its disadvantages, compared with partial endoprosthesis are: more extensive and longer operative procedures, increased blood loss, increased infection risk and mortality, longer rehabilitation period and higher costs [20,21]. Total hip endoprosthesis was shown to be a satisfactory salvage procedure after failure of other surgical solutions for femoral neck fracture [22].

"In vitro" experiments cannot offer absolutely accurate data, due to many complex characteristics of structures of implant, bone, cement, and some uncertain numerical parameters. This emphasizes a need for clinical studies, which could ensure more realistic data about behavior of different endoprosthetic devices "in vivo" in order to confirm present methods in treatments and point to some critical moments. There is no

published study which compared long-term clinical outcome among unipolar, bipolar and total hip endoprostheses after femoral neck fracture.

Aim of this study was to compare long-term clinical outcomes after implantation of three different types of hip endoprostheses after femoral neck fracture.

Patients and Methods

In this prospective study we collected hospital archive data only for patients with following inclusion criteria:

- dislocated medial femoral neck fracture (Garden type III and IV),
- absence of X ray visible degenerative pathological changes,
- unilateral lesion,
- implantation of cemented hip endoprosthesis as primary procedure by lateral surgical hip approach,
- minimal follow up of 18 months,

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- surgical procedure performed since Jan/98.

The patients were divided in three groups:

- The first group consisted of 32 patients treated with partial unipolar hip endoprosthesis «Austin Moore, Instrumentaria DOO Zagreb, Croatia»,
- The second group consisted of 70 patients treated with partial bipolar hip endoprosthesis «Vario-cup, Link GmbH&Co Hamburg, Germany» and
- The third group consisted of 43 patients treated with total hip endoprosthesis «Lubinus, Link GmbH&Co Hamburg, Germany». Three groups differed only by the type of implanted endoprosthesis.

The first group was consisted of consecutive patients who have been operated at Dept. of orthopedics and traumatology, Clinical centre University of Sarajevo. The second and third group was of the randomly chosen patients at Dept. of traumatology, Clinical centre Ljubljana. Although all patients have not been operated by the same surgeon, all of them have been operated by the same surgical approach and have had the same pre and postoperative surgical protocol.

The unipolar partial endoprosthesis is constructed as one piece; the head, the neck and the stem are made from the same material, and differ only in radius of the head and length of the neck and the stem. The bipolar endoprosthesis consists of a smaller polyethylene cup, tightened to the stem. The external cup's outside surface articulates with the acetabulum and inside surface with the internal cup. This double mobility decreases number of motions between the acetabular cartilage and the articulation surface of the endoprosthesis, and consequently, acetabular erosion. In case of complications, it is possible to transform bipolar endoprosthesis into the total hip endoprosthesis by an implantation of an artificial acetabulum, while unipolar partial endoprosthesis has to be completely removed in case of certain complications.

All patients were followed up for a mean period of 3.8 ± 1.9 years and their clinical outcomes were evaluated by Harris hip score.

Harris hip score evaluates following hip parameters:

- hip pain (painless hip44 points),
- presence of deformity (no deformity4 points),
- range of motions (full motions5 points),
- functional tests (complete functionality.....47 points):
- Completely healthy hip.....100 points.

We have chosen Harris Hip Score for evaluation of long term clinical outcome because of its high validity and accuracy and its easy comparison with other evaluation scales [23,24]. Henning deems that satisfactory and better clinical outcomes are over 50 points of HHS, but for Lestrange, fair clinical outcome are values HHS over 70 points [25,26].

Statistical analysis was performed by Chi2 test and one-way ANOVA (Analysis of variance). The p value of 0.05 was deemed statistically significant.

Results

Hospital archive data for 692 patients was collected according above mentioned inclusion criteria. Patients lost to follow up, dead patients

PARAMETER	UNIPOLAR P.	BIPOLAR P.	TOTAL P.	P
AGE ¹	75	78	73	0.091
FOLLOW UP ¹	3.31	3.91	4.08	0.073
CARDIO VASCULAR ²	53	68	70	>0.1
NEUROLOGICAL ²	16	11	13	>0.1
PULMONARY ²	12	10	11	>0.1
DIABETES MELLITUS ²	16	17	16	>0.1
PAIN ¹	37.7	37.9	36.87	>0.1
LIMPING ¹	6.27	9.63	7.77	0.001
HHS ¹	72.06	74.27	78.23	>0.1
IN-HOSPITAL MORTALITY ²	4.3	4.6	5.3	>0.1

¹ - Numerical parameters measured in years, statistical difference calculated by ANOVA.

² - Frequencies of diseases measured in percentages, statistical difference calculated by Chi²-test.

Table 1: Age, follow up, and frequency of comorbidities with level of significance in three groups.

and patients with incomplete data were excluded from the further analysis. In examined group of one hundred forty five patients, 85% were female and the mean age was 76 ± 5.1 y. The mean period from injury to surgery was 2.9 ± 1.3 days. The most common comorbidities were: cardiovascular diseases in 66% (96 patients), diabetes mellitus in 17% (25 patients), neurological diseases in 13% (19 patients) and pulmonary diseases in 10% (14 patients).

There were no statistical significant differences between three described groups in parameters which could influence the long-term clinical outcome (age, follow up, comorbidities).

Total hip endoprosthesis achieved the highest values of the Harris hip score, 78.23 ± 22.46 , which has not differed significantly ($p=0.704$) from scores of unipolar and bipolar hip endoprostheses.

The mean of HHS values in all three groups (74.95 ± 19.52 96), can be considered as fair, according to Lestrange [26]. The patients with implanted unipolar endoprosthesis had lower in-hospital mortality rate, but statistically not significant (Table 1).

Discussion

In our study, the majority of patients were octogenarian females with numerous comorbidities. Comorbidities and pre-injury conditions are significant factors that influence hip fracture after mild trauma [27]. Since a percentage of elderly people are on rise in nowadays, geriatric diseases and injuries are becoming more important issue. Due to difficulties in treatment of the hip fracture, recovery is exhausting for patients and expensive for society.

Harris hip score is an objective measure of long-term clinical outcome and the best tool in estimating treatment's success. An average value of HHS 74.95 ± 19.52 (similar in other studies) indicated that a patient with implanted hip endoprosthesis after femoral neck fracture had periodic pain that did not affect her/his activities, could walk without problems at least 500 meters, limped to a certain degree, used a cane, could climb stairs holding a handrail, sat in the chair for a long time, put on shoes and socks with minor difficulties, used the public transportation and had no distinct deformity of the hip. With that level of hip functionality, our patients after endoprosthetic hip replacement are able for independent living, what is the main personal, medical and social goal for their age. Although average HHSs in all three groups were in domain of "fair" (by Lestrange), HHS of the bipolar partial endoprosthesis evaluated in this study is 2 points beyond HHS of the unipolar endoprosthesis (74 vs. 72), and only 4 points below the total endoprosthesis (74 vs. 78).

The mean in-hospital mortality rate in all three groups (4.7%) was similar to Goldhill's report (5.7%), and Lyons's report (4.3%) [28,29]. Slightly higher in-hospital mortality rate in group of patients with implanted total hip endoprosthesis (5.3%) compared with groups of patients with partial hip endoprostheses (4.5%) could be attributed to longer and more extensive surgery of implantation of total hip endoprosthesis and increased blood loss during surgery. Patients with implanted bipolar endoprosthesis had the lowest level of pain, limp and in-hospital mortality rate. Ichihashi supported use of the bipolar endoprosthesis in the femoral neck fracture and even after avascular necrosis of the femoral head, though he was uncertain about use of this endoprosthesis in patients who suffered from the hip arthrosis [30].

Considering clinical results of this study, blood loss, duration of surgical procedure, possibility of revision, time of functional recovery and price of endoprosthesis, all types of endoprostheses are valuable for surgery of the hip. Although our groups were uniform and their HHS values were similar, decision about type of endoprosthesis should not be uniform. Total endoprosthesis is the logical choice in patients with previously damaged hip, unipolar endoprosthesis is the most rational choice for patients with short life expectancy. For others with displaced femoral neck fractures, bipolar partial endoprosthesis seems to be acceptable and compromising way of treatment.

The limitations of this study are as follows: relatively small number of participants, the lack of severity of illness score and relatively short follow up. However, studies with similar limitations have been published in the literature and may have helped clinicians in decision making. Clearly, more comprehensive study on this subject is lacking and it may help to further answer new issues that arise.

In conclusion, a choice of endoprosthesis is not the crucial obstacle in patient's recovery to a pre-surgery state. It is only natural that a choice of an implant must be evaluated in accordance with clinical benefits of a chosen endoprosthesis on the one hand, and with general condition of a patient and economic factors on the other.

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