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Primary total hip arthroplasty for displaced intracapsular fracture of the femoral neck: Medium-term functional and radiographic outcomes

Research Article

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Abstract: The number of complications after primary total hip arthroplasty for displaced intracapsular fractures of the femoral neck is higher than that after operations for osteoarthritis. The aim of this study is to evaluate the number of complications and mid-term functional and radiological findings of patients after primary THA for displaced intracapsular fractures of the femoral neck. Between 1995 and 1998, we operated on a total of 89 patients for acute displaced intracapsular fractures of the femoral neck, i.e. Garden Type 3 and 4. In all the patients we evaluated intraoperative and early postoperative complications. We reviewed clinical and radiological results in 65 patients. The only intraoperative complication was abruption of the greater trochanter. Early postoperative complications occurred in 13 patients (15%). The specific complications, THA dislocation, occurred in 3 patients. Non-specific complications were recorded in 10 patients. No delayed healing of the surgical wound, neural lesion or early, delayed or late infection was recorded. Of 65 patients followed-up for an average of 78 months (range, 62-109 months), 8 patients underwent revision surgery. Of 57 patients with primary THA, very good and good clinical results according to the Harris Hip Score were recorded in 48 patients (84%) and poor results in only 2 patients (4%). Nine of 57 followed-up patients showed radiological signs of loosening (16%). The radiolucent line could be seen in 3 patients in the region of the cup, in 1 patient in the region of the femoral component and in 5 patients in both components. Clinical complaints that would result in indication for reimplantation were recorded in none of the mentioned patients. Number of complications, functional results and resumption of full self-reliance by patients after THA for an intracapsular fracture of the femoral neck are so positive that we consider the indication of THA for a displaced femoral neck fracture fully justified.

Keywords: *Displaced intracapsular fractures of the femoral neck • Primary total hip arthroplasty • Mid-term functional and radiographic results*

1. Introduction

Primary total hip arthroplasty (THA) for displaced intracapsular fractures of the femoral neck, according to most authors, is indicated in patients who are older than 70 years, physically active and cooperative, and in a good general condition [1-9]. However, some authors point out that the rate of complications in the early postoperative period and failures of the arthroplasty later due to loosening of individual components is higher when compared to the rate of complications following THA for osteoarthritis [10-13]. The purpose of this study was to determine the medium-term functional and radiographic outcomes in patients who had undergone primary THA for displaced intracapsular fractures of the femoral neck, and to discuss if our results sufficiently support the primary indication of THA for displaced intracapsular fractures of the femoral neck.

2. Material and Methods

2.1. Patients

Between January 1995 and December 1998, we performed primary total hip arthroplasty on 89 consecutive patients with acute displaced intracapsular

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Table 1. Overview of implanted THA components.

Components	Cemented cups		Cementless cups			Total
	*Poldi***	*Ultima****	*Ultima****	*Spotorno**	*Bicon*****	
*Geradschaft**	12	32	2	6	3	55
*Poldi***	8	10	1	1	1	21
*MS-30**	0	1	3	6	3	13
Total	20	43	6	13	7	89

** SulzerMedica, ** Beznoska, *** Johnson&Johnson, **** Endoplus*

Table 2. The indications for implantation of specific components.

	*Anatomical situation**	*Age or bone quality*
Femoral components		
- Geradschaft	CD angle < 135°	age > 60 y
- Poldi	CD angle > 135°	age > 60 y
- MS-30	CD angle < 135°	age < 59 y
*Cemented cups***		
- Poldi (1995-1996)	spherical acetabulum	age > 60 y
- Ultima (1996-1998)	spherical acetabulum	age > 60 y
Cementless cups		
- Ultima	spherical acetabulum	age < 59 y, good bone quality
- Spotorno	non-spherical acetabulum	good bone quality
- Bicon	non-spherical acetabulum	poor bone quality

**CD angle was measured on the radiograph of the contralateral unharmed hip*
***See Discussion*

fractures of the femoral neck, i.e. Garden Type 3 (40 patients) and Garden Type 4 (49 patients). The 89 patients included 66 women and 23 men with a mean age of 68 years (range, 41-85 years).

2.2. Operative Technique

Patients were operated on in the supine position using the modified anterolateral Watson-Jones approach (81 patients) or the transgluteal approach (8 patients). Cemented components were implanted in 63 patients while hybrid THA, i.e. a cementless cup and a cemented stem, was used in 26 patients. Two types of cemented cups, three types of cementless cups, and three types of cemented femoral components were used (Table 1). Component selection was based on the specific anatomical situation of each patient (i.e. the neck-shaft angle and the shape of the medullary canal in the femoral component selection, the shape of the acetabulum in the cup selection) and the bone quality (in the selection of cemented and cementless components); the indications for specific component selection are listed in Table 2. Cemented components were fixed by Palacos cement. The hip was always drained for 24-48 hours.

2.3. Perioperative Management

Parenteral antibiotic prophylaxis with cefazolin was begun prior to the incision and continued for 48 hours afterward. Thromboembolic prophylaxis with subcutaneous heparin was started immediately upon the patients' admission to the hospital and was continued until the patients managed to walk independently (in 7 to 10 days). High risk patients, those with previous big thromboembolic events or those who were obese, were administered low-molecular heparin. Once the patients had started walking, warfarin was used for a period of 8 weeks.

Patients started to walk with crutches without bearing weight on the operated limb on the second or third day after the surgery. Gradual weight-bearing was allowed after the first follow-up visit at 6 weeks and full weight-bearing was permitted three months after the surgery. This practice was applied during the followed period in all the patients with either one or both cemented components implanted.

2.4. Study Design

The study period 1995-1998 was chosen to allow for a medium-term follow-up of 5 to 10 years. Patient data were recorded prospectively and analyzed retrospectively. Detailed physical examinations were performed postoperatively at 6 weeks, 3 months, 6

months, 1 year, and every 2 years thereafter. In addition, the following information was collected and recorded:
- intraoperative complications,
- early postoperative complications,
- late postoperative complications,
- Harris Hip Score (HHS),
- radiographic findings of loosening of individual components based on generally accepted criteria [14-16].

2.5. Ethical Considerations

Approval to perform this study was obtained from the research review board and the local ethics committee.

2.6. Statistical Analysis

Statistical analysis was performed using the Spearman correlation coefficient, the contingency table test (chi-squared and the Fisher test of accuracy) and the Wilcoxon test. The level of significance for these tests was set at 5%. Statistical calculations were made by means of the SPSS program for Win v.14.

3. Results

During the study period, 24 patients (27%) died and 8 additional patients (9%) underwent revision surgery. As a result, THA survivorship was evaluated in 65 patients and functional outcomes were evaluable in 57 patients (64%).

3.1. Complications

Intraoperative complications: There was only one intraoperative complication, namely abruption of the greater trochanter, which was repaired by wire cerclage.

Early postoperative complications: Early postoperative complications were noted in 13 patients (15%) – Table 3. THA dislocation occurred in 3 patients (4%), on 4th, 6th and 16th postoperative day, respectively. All dislocations were treated by closed reduction under general anaesthesia and none of them recurred. No delayed healing of the surgical wound, neurogenous lesion or infection was recorded.

Table 3. Postoperative complications.

Complication	Number
Specific	3
- THA dislocation	3
Non-specific	10
- myocardial infarct	2
- flebothrombosis	2
- pulmonary embolism	1
- urinary tract infection	3
- decubital ulcer	2

3.2. Functional and Radiographic Outcomes

Functional and radiographic outcomes were evaluable for the cohort of patients that did not die or require revision arthroplasty during the study period. The cohort was comprised of 57 patients (42 women and 15 men) with a mean age of 68 years (range, 41-80 years).

Follow-up period: The mean follow-up period was 78 months (range, 62-109 months).

Clinical outcomes: The overview of clinical findings evaluated according to HHS is presented in Table 4. Very good and good results were achieved in 84% of patients. Poor clinical findings were recorded in only 4% of the patients. The Spearman correlation coefficient ρ=-0,153 was statistically insignificant (p=0,257); as a result association between age and HHS has not been proved.

Radiographic outcomes: Nine of 57 patients (16%) showed radiographic signs of loosening. The radiolucent line could be seen in 3 patients in the region of the cup, in 1 patient in the region of the femoral component, and in 5 patients in both components. Clinical complaints that would result in indication for reimplantation were recorded in none of the mentioned patients. Overview of data on these patients is included in Table 5. The Wilcoxon test has not proved a statistically significant difference in terms of age between patients with signs of loosening and those without them (p=0,749).

Impact of the type of individual implants: Loosening occurred in 1 of 26 hybrid implants (4%) and 7 of 63 cemented implants (11%). Using the Fisher test of accuracy, this difference was insignificant (p=0,437). Refer to Table 6 for the overview of loosened components.

Table 4. Evaluation of the clinical finding based on the Harris Hip Score during the follow-up examination (average age of individual patient subgroups is based on their age at the time of surgery).

HHS	91-100 points	81-90 points	71-80 points	Less than 70 points	Total
Women	24	12	5	1	42
Men	8	4	2	1	15
Total	32	16	7	2	57
Average age	67	70	71	66	68

Table 5. Overview of patients with a radiological finding of radiolucent lines at the time of the follow-up examination.

Patient	1	2	3	4	5	6	7	8	9
Gender	w	w	w	m	w	w	m	m	w
Age at the time of follow-up (years)	80	85	75	72	85	80	86	60	73
Surgery-follow-up interval (months)	62	64	69	77	79	85	99	101	103
Harris Hip Score	79	84	78	93	95	83	72	97	88
*Cup**	I,II	I,II	I,II		I,II	III	III	I	I,II
*Femoral component***		1,2,6,7	1,7	1,7		1,7	1,7	1,7	

** Finding of a radiolucent line in the zone after De Lee and Charnley [14]*
*** Finding of a radiolucent line in the zone after Gruen et al. [16]*

Table 6. Overview of primary components that had to be reimplanted in the followed-up patients.

Component	Followed-up patients	Loosening (N)	Loosening (%)
Cemented Poldi cup	9	3	33%
Cemented Ultima cup	29	4	14%
Cementless Ultima cup	5	1	20%
Geradschaft femoral component	43	2	5%
Poldi femoral component	11	1	9%

3.3. Subgroup of patients who required THA reimplantation

At the time of the evaluation of mid-term outcomes, 8 patients (9%) of the basic group (6 women and 2 men) had undergone revision surgery for aseptic loosening of one of the components. The mean age at the time of the primary THA for this group of 8 patients was 69 years (range, 50-78 years); the mean age at this time was 71 years in women (range, 67-78 years) and 62 years in men (range, 50-73 years). THA survivorship in these 8 patients was on average 65 months (range, 29-109 months). We were unable to identify any intraoperative or postoperative complications or any other factors in the history of these patients that might have been responsible for the early loosening of components. For details on all 8 patients see Table 7.

4. Discussion

We present our experience with medium-term clinical and radiographic outcomes of total hip arthroplasty for displaced intracapsular fracture of the femoral neck and provide a discussion comparing our results with outcomes reported in the literature.

4.1. General characteristics of our study cohort

The mean age of our study cohort at the time of surgery was 68 years (70 years for women and 63 years for men), which is lower than what others have reported for patients who have had arthroplasty for the same indication (72-80 years) [4,6,9,12,13,17-24]. However, the mean age of patients in our cohort increased over time and reached values comparable to the mean age reported by others in the last two years of evaluation [18,23,24]. Following the recommendations of other authors during the period of this study, we began to suggest THA for older patients. Currently the mean age of patients with THA performed because of femoral neck fracture in our department is 74 years. On the other hand, the mean age of our study cohort at the time of surgery was higher than the mean age (at time of surgery) of patients in our department that had undergone THA for primary osteoarthritis of the hip [25-28].

4.2. Complications

Several authors have reported higher incidence of postoperative complications after THA for a traumatic indication [6,7,11-13,29]. Greenough and Jones observed a rate of 8% dislocations and 29% internal complications in their cohort [11]. Narayan and George observed 4% dislocations [29]. Ruchholtz et al. reported a 5% rate of additional interventions after traumatic THA for haematomas, seromas and infections [12]. Schleicher et al. noted a 61% incidence of both specific and non-specific complications [6]. Of these 2% were dislocations, 6% delayed wound healing, and 17% internal inflammatory complications; however the median age of patients in their cohort was 80 years. Sharma et al. observed 22% local complications (2% delayed wound healing and 2% dislocation) and 19% general complications (7% deep vein thrombosis) [7]. Taine and Armour reported 12% dislocations and 6% delayed surgical wound healing including infections [13]. Compared to these, the incidence of postoperative

Table 7. Overview of patients after THA reimplantation at the time of follow-up.

Patient	1	2	3	4	5	6	7	8
Gender	m	w	w	w	w	w	w	m
Age at the time of surgery (years)	73	68	72	72	68	68	67	50
Injury-surgery interval (days)	5	1	2	2	2	2	4	5
Duration of surgery (minutes)	100	90	140	80	60	90	90	90
Surgery-discharge interval (days)	12	11	21	14	14	11	10	11
Loosened component	cup	cup	cup	both	cup	both	cup	both
Surgery-reoperation interval (months)	47	29	42	36	60	70	101	109

complications in our cohort was lower. However, when compared to THA indicated for osteoarthritis, THA indicated for trauma is associated with a higher percentage of complications [22, 25-27, 30-33]. Similar to others, we feel that the higher the mean age of patients, the worse the general condition, and a poorer quality of the muscle tissue contributes to a higher incidence of postoperative complications after THA for a fracture of the femoral neck [10,20,30,34].

4.3. Follow-up period

Patients were followed-up for a period of 5.1 to 9.1 years, which would be considered a medium-term follow-up. As a rule, the mean follow-up in studies similar to ours is 2-5 years [1,4,9,11,17,21-23]. Only a few studies have reported medium-term results (Healy and Iorio – 5-8 years, average 5.9 years; Schleicher et al. – 4.6-11.8 years, average 8.1 years; Sharma et al. – 3-9.6 years, average 5.8 years) [6,7,20].

4.4. Clinical outcomes – HHS

Eighty-four percent of our patients had very good and good HHS scores (81-100 points). Only two patients, one 85 year-old female patient and one patient who was permanently bed-ridden after vascular cerebral palsy, had poor HHS scores (70 points or less). These outcomes are worse when compared to medium-term outcomes reported from studies of patients after THA for a degenerative hip disease [32,33,35-37]. HHS scores of patients with THA for degenerative hip disease in our department were also better [25,27]. However, we share the opinion of others that it is necessary to compare outcomes in patients after THA for a femoral neck fracture with outcomes in patients treated for the same diagnosis by different methods (internal fixation, hemiarthroplasty) where the benefit of THA is quite evident [1,6,9,18-21,23,24,38-44].

Eight patients (12%) required revision arthroplasty. This is a higher rate than is usually noted in long-term studies of well-established THA [44]. However, we believe that it is logical that the clinical outcomes of THA implanted for a femoral neck fracture are worse. Absence of sclerotic subchondral bone in the acetabular region, evident in degenerated hip and poorer quality of the bone (osteoporosis) in older patients, worsen the conditions for long-term fixation of components in contrast to the situation in patients undergoing THA due to degenerative changes of the hip [3,10,25-27,33,46,47].

4.5. Radiographic outcomes

Radiolucent lines of varying sizes surrounding one of the components were identified in 9 patients (16%). This rate is again quite high when compared to the radiographic outcomes of patients with primary osteoarthritis of the hip as their indication for THA [32,35,48]. We have not been able to find any reports in the medical literature of medium- or long-term radiographic outcomes in patients who had undergone THA for a traumatic indication.

4.6. Impact of the type of individual implants

We used many different implants and this might be a limitation of the study. However, the choice of implants respected the indication scheme applied at our department, which corresponds to widely accepted recommendations based on the anatomical situation and the bone quality assessment (see Table 2). We did not discover any statistically significant influence of the implanted components on loosening. Nevertheless loosening occurred in 33% of cemented cup Poldi (see Table 6), which confirmed our previous experience and led to cessation of this cup implantation during the study.

In conclusion, medium-term clinical and radiographic outcomes after THA indicated for a femoral neck fracture showed that the functional results and resumption of full self-reliance by these patients are positive. We conclude that the indication of THA for a displaced femoral neck fracture is fully justified.

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