

The uncemented bipolar hemiarthroplasty for displaced femoral neck fractures

6-year follow-up of 171 cases

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We report a study of 168 consecutive patients (171 prostheses) with a displaced femoral neck fracture and a physiologic age older than 75 years who were treated with an uncemented bipolar Monk hard-top hemiarthroplasty. Four prostheses dislocated postoperatively, but none after discharge. Two prostheses were later extracted. Five patients sustained an ipsilateral femoral fracture. Totally, 7 patients (4 percent) were reoperated on.

One year after the operation, 22 percent of the patients were dead. An increased mortality rate was recorded during the first 6 months after surgery. At follow-up 6 (3-9) years after the operation, 4 of the 62 patients alive had weight-bearing pain. Three had subsidence of the prosthesis, but none had protrusion of the acetabulum. Ninety-five percent of the patients were free from complications requiring a reoperation or outpatient evaluation.

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Patients sustaining a displaced femoral neck fracture are currently treated either with internal fixation or with an endoprosthesis. Internal fixation is preferred in Scandinavia, but the method is complicated by a high frequency of redisplacement, nonunion, and segmental collapse (Sikorski and Barrington 1981, Strömqvist et al. 1984, Skinner and Powles 1986, Christie et al. 1988, Elmerson et al. 1988, Nilsson et al. 1988 and 1989). The primary failure may cause prolonged disability, and the patients run the risks of long periods of pain, immobility, and repeated operation. In younger and more fit patients with displaced fractures, it is advantageous to conserve the femoral head; but the treatment of the older patients is controversial.

Since 1979, we have used a bipolar hemiarthroplasty in patients with a physiologic age above 75 years. We report a long-term follow-up study of the incidence of early and late complications requiring outpatient evaluation or a reoperation.

Patients and methods

From 1979 through 1984, a total of 169 consecutive patients with 172 fractures were treated with a hemiarthroplasty at the Department of Orthopedics, Sønderborg County Hospital, Denmark. Patients

with a physiologic age above 75 years and a displaced nonpathologic femoral neck fracture (Garden types 3 and 4) were included (Garden 1961). The records of 1 patient were lost, leaving 133 women and 35 men (171 prostheses) to be followed up. The median age at the time of surgery was 81 years, and the 10 and 90 percentiles were 72 and 89 years, respectively (Table 1).

On admission, plaster-cast traction was applied. The operations were performed a median of 1.7 (0-15) days after admission using general anesthesia and a posterior approach.

All the prostheses except one were inserted without cement. The prosthesis (Monk[®] Doublet[®] hemiarthroplasty) is bipolar and the stem, made of titanium alloy, has two fenestrations. The acetabular assembly is made of polyethylene, and is covered by a metal cup, which articulates with the natural acetabulum.

Prophylactic antibiotics and heparin were used. All the patients were mobilized fully weight bearing after the operation. After discharge, it was necessary to examine 14 patients in the outpatient clinic to ensure rehabilitation.

At follow-up, the records of all the patients were checked. All the surviving patients received a questionnaire, and the patients not answering were subsequently interviewed by telephone. Finally, all the patients with hip pain were offered a clinical and a radiographic examination.

Table 1. Observations in 171 cases of uncemented bipolar hemiarthroplasty for displaced femoral neck fractures

Case	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Case	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	2	84	3	3	-	1	3	-	9	3	-	-	48	-	-	-	-	-	71	2	81	1	3	3	2	2	4	123	2	-	-	-	63	1	2	2	1
2	1	83	3	3	-	1	3	-	15	5	-	-	54	-	-	-	-	-	72	2	63	1	1	3	1	3	1	30	2	-	-	-	61	1	1	1	1
3	2	89	3	3	-	2	3	-	11	1	-	-	23	-	-	-	-	-	73	2	71	3	3	3	4	4	4	12	1	-	-	-	71	1	1	2	1
4	2	91	1	1	-	1	2	-	40	4	-	1 ^a	61	-	-	-	-	-	74	2	72	1	1	1	1	2	2	20	3	-	-	-	61	1	1	1	2
5	1	86	1	1	-	1	2	-	37	10	-	-	40	-	-	-	-	-	75	2	81	1	1	2	2	3	3	32	1	-	-	-	77	1	1	1	2
6	2	80	1	1	-	1	3	-	28	2	1	-	42	-	-	-	-	-	76	2	77	1	1	1	1	2	1	21	1	-	-	-	54	1	1	1	2
7	2	87	1	1	-	1	3	-	32	2	-	-	24	-	-	-	-	-	77	2	67	1	1	3	1	2	3	20	3	-	-	-	84	1	2	2	2
8	2	78	1	3	-	2	2	-	29	3	1	-	27	-	-	-	-	-	78	2	77	1	1	1	2	2	17	2	-	-	-	64	1	1	1	2	
9	2	82	3	3	-	1	3	-	11	6	1	-	14	-	-	-	-	-	79	2	83	1	2	3	2	3	17	1	-	-	-	57	1	2	2	1	
10	2	83	1	1	-	1	3	-	24	4	-	-	37	-	-	-	-	-	80	1	82	1	1	1	1	2	4	25	3	-	-	-	86	1	2	2	1
11	2	85	1	1	-	1	3	-	38	0	-	-	34	-	-	-	-	-	81	1	74	1	2	1	3	4	3	22	6	-	-	-	48	1	2	2	2
12	2	84	1	1	-	1	2	-	36	2	-	-	38	-	-	-	-	-	82	2	77	1	2	1	2	2	4	42	2	-	-	-	50	1	2	2	1
13	2	89	1	1	-	1	2	-	12	1	-	-	12	-	-	-	-	-	83	1	85	3	3	3	2	3	4	15	2	-	-	-	50	1	2	2	1
14	2	74	1	4	-	1	3	-	4	1	-	-	11	-	-	-	-	-	84	2	83	1	4	1	2	3	2	7	1	-	-	-	81	1	2	1	1
15	2	93	3	3	-	6	5	-	14	2	-	-	11	-	-	-	-	-	85	1	70	1	2	1	2	3	2	32	4	-	-	-	102	3	2	2	1
16	2	93	3	3	-	3	3	-	7	1	-	-	46	-	-	-	-	-	86	2	78	1	4	3	1	4	4	6	2	-	-	-	51	1	2	2	1
17	2	82	1	1	-	1	3	-	29	1	-	-	15	-	-	-	-	-	87	2	85	1	1	1	1	3	2	23	5	-	-	-	45	1	1	1	2
18	2	85	3	3	-	4	4	-	7	2	-	-	0	-	-	-	-	-	88	2	82	1	1	1	1	3	2	25	5	-	-	-	61	1	1	2	1
19	2	88	1	1	-	1	3	-	47	3	-	-	16	-	-	-	-	-	89	2	89	1	4	1	1	3	2	16	1	-	-	-	78	1	2	2	2
20	2	87	3	3	-	6	3	-	16	6	-	-	1	-	-	-	-	-	90	2	72	1	4	1	1	3	1	11	1	-	-	-	56	1	1	1	2
21	2	85	3	3	-	2	4	-	6	1	-	-	5	-	-	-	-	-	91	2	89	3	3	3	2	3	3	14	3	-	1 ^a	-	111	1	2	2	2
22	1	94	3	3	-	2	3	-	13	1	-	-	43	-	-	-	-	-	92	2	76	1	4	.	1	3	.	10	4	-	68	-	-	-	-	-	
23	1	84	3	3	-	4	4	-	9	2	-	-	7	-	-	-	-	-	93	1	73	1	1	1	1	2	2	25	3	-	-	-	49	3	1	1	2
24	1	81	1	3	-	2	3	-	259	1	4	-	9	-	-	-	-	-	94	2	74	1	1	1	1	2	2	26	2	-	-	-	109	1	1	1	2
25	1	75	1	3	-	1	2	-	63	9	-	-	52	-	-	-	-	-	95	2	76	1	2	2	1	3	3	30	2	-	-	-	82	1	1	2	2
26	1	73	1	1	-	3	4	-	52	1	3 ^a	-	2	-	-	-	-	-	96	2	74	1	1	1	1	3	2	30	3	-	-	-	85	3	1	1	2
27	1	80	3	2	-	3	4	-	9	1	-	-	4	-	-	-	-	-	97	1	81	1	4	1	6	3	2	7	1	-	-	-	71	1	1	1	2
28	2	83	3	3	-	2	3	-	7	0	-	1	18	-	-	-	-	-	98	2	86	1	1	3	1	2	4	30	2	-	-	-	70	1	2	2	2
29	2	86	3	3	-	6	3	-	8	1	-	-	15	-	-	-	-	-	99	2	87	1	3	3	2	3	4	115	2	-	-	-	57	1	2	2	2
30	2	82	1	3	-	3	3	-	9	1	2	-	12	-	-	-	-	-	100	1	80	1	4	3	1	4	2	7	2	-	-	-	61	1	2	2	1
31	2	81	2	2	-	2	3	-	19	15	-	-	19	-	-	-	-	-	101	2	77	1	1	1	1	2	1	60	3	4	-	-	62	1	1	1	2
32	1	85	3	3	-	2	3	-	20	1	-	-	4	-	-	-	-	-	102	2	75	1	1	1	1	2	2	26	4	-	1 ^a	-	106	1	2	2	2
33	2	76	3	3	-	6	4	-	44	2	4	-	13	-	-	-	-	-	103	2	71	1	1	1	1	2	1	30	1	-	-	-	96	1	1	1	2
34	2	82	3	3	-	2	4	-	14	2	-	-	14	-	-	-	-	-	104	2	77	1	1	1	1	3	2	16	1	-	-	-	55	1	1	1	2
35	1	85	1	1	-	1	2	-	54	2	-	-	45	-	-	-	-	-	105	2	68	1	1	.	1	2	27	5	-	-	113	-	-	-	-	-	
36	2	87	1	2	-	1	4	-	10	2	-	-	34	-	-	-	-	-	106	2	71	2	2	2	2	2	2	22	1	-	-	-	66	1	1	1	2
37	2	80	1	3	-	1	2	-	58	6	-	-	55	-	-	-	-	-	107	2	74	1	1	1	1	2	3	29	6	-	2 ^a	-	112	1	2	2	2
38	2	82	1	1	-	1	3	-	59	3	-	-	30	-	-	-	-	-	108	2	87	3	3	3	1	3	4	10	2	-	-	-	47	1	2	2	1
39	2	88	1	4	-	1	3	-	4	1	-	-	1	-	-	-	-	-	109	2	69	1	1	1	1	2	2	15	3	-	-	-	60	1	1	1	2
40	2	93	3	3	-	6	3	-	13	3	-	-	1	-	-	-	-	-	110	1	64	3	3	3	1	2	1	14	1	-	-	-	54	1	1	1	2
41	2	79	3	3	-	6	3	-	15	2	-	-	64	-	-	-	-	-	111	1	82	1	3	3	2	3	4	49	0	-	-	-	55	1	2	2	1
42	2	83	3	3	-	2	3	-	27	3	-	-	65	-	-	-	-	-	112	2	81	1	3	3	3	3	4	30	2	-	-	-	67	1	2	2	1
43	2	88	1	1	-	2	2	-	28	1	-	-	20	-	-	-	-	-	113	2	77	3	3	3	1	3	4	16	2	-	-	-	73	1	2	2	1
44	2	81	1	4	-	1	3	-	6	1	-	-	54	-	-	-	-	-	114	2	81	1	1	1	1	3	2	45	1	-	-	-	81	1	1	1	2
45	2	81	1	1	-	1	2	-	23	1	-	-	17	-	-	-	-	-	115	1	83	3	-	2	-	-	15	6	-	-	-	0	-	-	-	-	
46	2	93	1	1	-	6	3	-	26	2	-	-	26	-	-	-	-	-	116	2	84	3	3	-	6	2	-	15	3	-	-	-	2	-	-	-	-
47	2	75	1	3	-	1	3	-	53	4	4	-	57	-	-	-	-	-	117	2	81	1	-	-	1	-	25	2	-	-	-	0	-	-	-	-	
48	2	81	1	1	1	1	2	1	21	3	-	-	80	1	1	1	2	-	118	2	86	1	1	-	1	2	-	46	2	-	-	-	4	-	-	-	-
49	1	76	1	1	1	1	2	1	18	3	-	-	88	1	1	1	2	-	119	2	78	1	1	-	1	2	-	15	3	-	-	-	1	-	-	-	-
50	2	78	1	1	1	1	3	2	60	2	-	-	73	1	2	2	2	-	120	2	92	3	3	-	2	2	-	27	1	1	-	18	-	-	-	-	-
51	2	86	1	1	1	1	2	1	19	2	-	-	59	1	1	1	2	-	121	2	89	1	3	-	1	4	-	30	2	-	-	24	-	-	-	-	-
52	1	85	1	1	3	1	3	3	18	2	-	-	56	3	2	2	2	-	122	2	72	1	1	-	1	2	-	35	2	-	-	32	-	-	-	-	-
53	2	69	1	1	2	2	2	2	40																												

Case	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Case	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
141	2	88	1	--	1	--	--	20	3	--	--	0	--	--	--	--	--	157	2	84	1	1	--	1	2	--	23	2	--	--	14	--	--	--	--		
142	2	80	3	3	--	6	3	--	14	3	--	--	1	--	--	--	--	158	2	86	1	3	--	2	3	--	10	3	--	--	30	--	--	--	--		
143	1	77	1	1	--	1	2	--	16	1	--	--	84	--	--	--	--	159	2	83	1	1	--	1	3	--	34	5	--	--	16	--	--	--	--		
144	2	95	3	3	--	6	4	--	7	1	--	--	14	--	--	--	--	160	2	80	1	1	--	1	3	--	48	10	--	--	23	--	--	--	--		
145	2	74	1	3	--	1	3	--	93	3	--	--	6	--	--	--	--	161	2	82	2	2	--	3	3	--	21	2	--	--	45	--	--	--	--		
146	1	76	1	1	--	1	2	--	30	2	--	--	45	--	--	--	--	162	2	81	1	--	2	--	2	--	25	1	--	--	1	--	--	--	--		
147	2	73	1	--	--	2	--	12	3	--	--	0	--	--	--	--	--	163	2	75	1	1	--	6	3	--	36	2	--	--	105	--	--	--	--		
148	2	78	1	1	--	2	3	--	34	3	--	--	25	--	--	--	--	164	2	86	1	4	--	1	4	--	4	1	--	--	54	--	--	--	--		
149	2	86	3	3	--	2	3	--	67	6	1,4	--	95	--	--	--	--	165	2	71	1	1	--	2	2	--	20	6	--	--	41	--	--	--	--		
150	2	94	1	1	--	2	3	--	27	1	--	--	54	--	--	--	--	166	2	80	1	1	--	2	2	--	29	2	--	--	42	--	--	--	--		
151	2	84	3	3	--	4	4	--	14	4	--	--	25	--	--	--	--	167	2	74	1	1	--	2	2	--	30	3	--	--	84	--	--	--	--		
152	2	81	1	3	--	2	3	--	91	6	--	--	66	--	--	--	--	168	2	75	3	3	--	4	4	--	10	2	--	--	58	--	--	--	--		
153	2	82	1	1	--	2	3	--	24	2	--	--	20	--	--	--	--	169	1	91	1	1	--	2	3	--	51	1	3 ^a	--	7	--	--	--	--		
154	2	84	1	4	--	2	4	--	7	3	--	--	66	--	--	--	--	170	1	89	3	3	--	2	3	--	16	2	--	--	12	--	--	--	--		
155	2	86	1	1	--	1	2	--	60	1	--	--	60	--	--	--	--	171	2	82	1	1	--	2	2	--	15	1	--	--	42	--	--	--	--		
156	2	73	1	1	--	1	3	--	51	8	3	--	5	--	--	--	--																				

Case numbers 55 and 56, 98 and 99, and 125 and 126 are bilaterally operated on patients.

- A Sex: 1 male, 2 female
- B Age at operation
- C Habitat preference
- D Habitat discharge
- E Habitat follow-up
 - 1 own home
 - 2 convalescence home
 - 3 nursing home
 - 4 local hospital
- F Walking aids, prefracture
- G Walking aids, discharge
- H Walking aids, follow-up
 - 1 none
 - 2 cane
 - 3 frame
 - 4 chair-bound
- I Hospitalization, days
- J Hospitalization, days preoperatively
- K Early complications
 - 1 fissure peroperatively
 - 2 fracture peroperatively
 - 3 dislocation
 - 4 superficial infection
 - 5 peroneal palsy
 - ^areoperated on
- L Late complications
 - 1 fracture
 - 2 deep infection
 - ^areoperated on
- M Dead, months postoperatively
- N Follow-up, months postoperatively
- O Pain, follow-up
 - 1 none
 - 2 at rest
 - 3 weight bearing
- F Walking distance, follow-up
 - 1 > 500 m
 - 2 < 500 m
- Q Walking capacity, daily outdoors, follow-up: 1 yes, 2 no
- R Hemiplegia or senility affecting walking capacity, follow-up: 1 yes, 2 no
- No observation because of death

Statistics

The Mann-Whitney test and the Fisher's exact test were used for unpaired variates; the 5 percent level was considered significant. For the assessment of the life table, the actuarial method was used. The standard mortality ratios were calculated using the age- and sex-specific mortality rates in Denmark (*Statistical Yearbook 1983*).

Results

Early complications

Five fissures, three in the calcar and two in the greater trochanter, resulted from the operation (Table 2). None required treatment, because the prostheses were found to be securely fixed. One patient had an unstable fracture through the lesser trochanter, and for this reason the prosthesis was cemented. All the patients were mobilized fully weight bearing after the surgery.

Four prostheses dislocated early during hospitalization. Two were treated with closed reduction and one with open reduction. One female patient with Parkinson's disease had her prosthesis extracted after having developed contractures of both hips before the operation.

In 6 patients, superficial wound infections were observed; however, 1 of these patients required an incision, and 1 had a peroneal palsy, which partly recovered.

Late complications

One patient had the prosthesis extracted 18 months after surgery because of a deep infection. None of the prostheses dislocated after discharge, and none required revision for aseptic loosening or protrusion of the acetabulum.

Five patients sustained an ipsilateral femoral fracture. One patient was treated for 3 months in traction. In 4 patients, internal fixation was performed with the Partridge Cerclene System (Jensen and Mossing 1985, Jensen et al. 1990). One

Table 2. Complications after uncemented hemiarthroplasty for a displaced femoral neck fracture in 168 patients (171 prostheses)

Complications	n	Reoperated on
Early		
Fissure perioperatively	5	-
Fracture perioperatively	1	-
Dislocation	4	2
Superficial infection	6	-
Peroneal palsy	1	-
Late		
Ipsilateral femoral fracture	5	4
Deep infection	1	1
Total	23	7

patient who died had had weight-bearing pain. None of the other patients who died had had complaints necessitating hospitalization or outpatient treatment. Later, when the patients were hospitalized for other reasons, no complaints related to the hip were recorded.

Follow-up

Sixty-two patients (48 women, 14 men) with 64 prostheses were alive at follow-up 6 (3-9) years after the operation. Seventeen percent of the patients died within 6 months, 22 percent within 1 year, and 48 percent within 4 years. An increased mortality rate was recorded during the first 6 months after the operation; but later, the mortality was similar to that of the standard population. Patients below aged 80 years had a higher standard mortality ratio than the older patients.

All 62 surviving patients answered the questionnaire. Thirty-six lived in private homes, whereas 26 lived in nursing or convalescence homes. Fifteen patients were chair-bound and one was bedridden—13 because of hemiplegia or senility, and 3 as a consequence of the hip fracture.

Ten patients were independently mobile without canes, 36 used canes or a frame, and 30 of these 46 patients were able to walk daily outdoors. Four had weight-bearing pain located deep in the thigh. None suffered pain in the groin or at rest. Patients with and without weight-bearing pain did not differ as regards age, observation time, and walking capacity farther than 500 meters.

In 3 of the 4 patients who had weight-bearing pain, the radiographic examination showed 0.5-1.5-

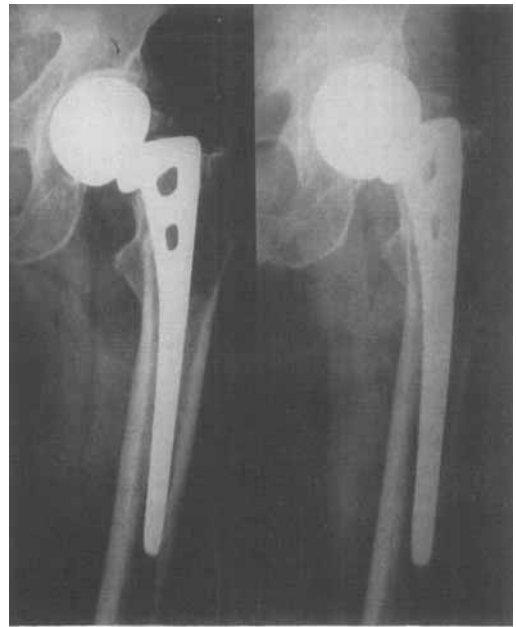


Figure 1. Monk hemiarthroplasty 6 months after the operation (left) and after 6 years (right). There are no signs of loosening or subsidence of the prosthesis or protrusion of the acetabulum.

cm subsidence of the prosthesis; also 1 patient had a 2-mm osteolytic zone around the neck of the prosthesis. One patient had a normal radiograph (Figure 1). Protrusion of the acetabulum was not found.

Discussion

Only a few studies have compared internal fixation and hemiarthroplasty in a prospective randomized study. Søreide et al. (1979) found that internal fixation was less time consuming, resulted in a shorter period of hospitalization, and was associated with a lower morbidity rate, whereas the prosthetic group had fewer reoperations and showed better results at the 1-year follow-up. Sikorski and Barrington (1981) found no difference in the mortality rate, but the internal fixed group had a higher rate of reoperations.

The frequency of complications after osteosynthesis of a displaced femoral neck fracture is high. Nonunion and redisplacement have been reported to be 13-43 percent, requiring reoperation in the majority. Segmental collapse has been found to be

7-17 percent, requiring reoperation in half of the cases. The overall incidence of complications requiring reoperation during the first 2 years after osteosynthesis of the displaced femoral neck fracture has been reported as high as 20-43 percent (Sikorski and Barrington 1981, Strömqvist et al. 1984, Skinner and Powles 1986, Christie et al. 1988, Elmerson et al. 1988, Nilsson et al. 1988, 1989, Rehnberg and Olerud 1989). Some authors have found the rate of complications higher in the older patients (Elmerson et al. 1988).

In our study, only 4 percent of the patients had been reoperated on after 6 years. This accords with Søreide et al. (1979) and Sikorski and Barrington (1981) after treatment with the Christiansen and Thompson prostheses, but after a shorter follow-up time.

Many of the patients with internally fixed fractures who are destined to suffer complications will not develop symptoms because of the mortality rate during the first year. In case of secondary arthroplasty, Nilsson et al. (1989b) found the procedure safe and successful.

In order to compare the two methods of treatment, the consumption of resources must be considered. Søreide et al. (1980a) found that the total costs of the treatment 1 year after the operation was 1.6 times higher in the prosthetic group due to higher consumptions during their hospitalization.

The hemiarthroplasty, especially the Monk soft top, has not been popular in Scandinavia in the treatment of a femoral neck fracture because of a high incidence of loosening (Mossing and Erin-Madsen 1980). However, the hard top, as used in this study, has shown good results (Lausten et al. 1987).

Protrusion of the acetabulum is a long-term complication of the hemiarthroplasty. Søreide et al. (1980b) found 54 percent protrusion, whereas other studies have shown no protrusion after 4 years using bipolar prostheses (Devas and Hinves 1983, Bochner et al. 1988). Phillips (1989) found that all the patients from nursing homes regardless of age and two thirds of the patients from private homes were inactive after the fracture, and they did not develop a protrusion. The other one third remained active, and a protrusion developed in most of them.

In the present study, none of the patients with pain had a protrusion, whereas 3 of 4 with femoral pain had subsidence of the prosthesis. We do not know the real incidence of protrusion, subsidence, and loosening; patients without pain were not offered a clinical and a radiographic follow-up examination, because these had been found to have no clinical consequences.

The mortality rate was 22 percent after 1 year, which agrees with several reports on hemiarthroplasty and internal fixation (Søreide et al. 1980a, Sikorski and Barrington 1981, Holmberg et al. 1986, Skinner and Powles 1986, White et al. 1987, Nilsson et al. 1988). The younger patients had the highest standard mortality ratio. This accords with the observations of White et al. (1987); and it was not unexpected, because the mortality rate for the younger standard population is much lower than that of the older one.

Totally, 95 percent of the patients in our study had no complications requiring outpatient evaluation or had a reoperation after the primary operation.

In conclusion, we found it advantageous to treat displaced femoral neck fractures with an uncemented bipolar hemiarthroplasty (Monk hard top) in patients with a physiologic age above 75 years because the frequencies of early and late occurring complications were low.

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