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Survival analysis of the cemented SPII stem

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Abstract The aim of this study was to evaluate the survivorship of cemented stems for hip replacement. From March 1989 to October 1991, 98 patients underwent total hip arthroplasty using the Lubinus SPII stem. The preoperative diagnoses included 73 cases of osteoarthritis, 17 fractures of the femoral neck, and 8 cases of aseptic loosening. The adopted acetabular cups were: in 59 cases a screwed cup V-Thabe (Waldemar Link, Hamburg, Germany); in 5 cases the press-fit cup Mallory-head (Biomet, Inc., Warsaw, IN, USA); in 3 cases a Muller cemented cup; and in 2 cases a cemented cup (Waldemar Link). In the 17 cases of fracture, a hemispherical biarticular cup was employed. The SPII (Waldemar Link) stem is made of a chrome-

cobalt alloy; it is smooth and 150-mm long. Its shape anatomically reproduces the curves of the femoral shaft. The neck had anatomical anteversion for the right and left femurs, and an inclination of 135°. Cementation was performed using CMW3 cement, mixed under vacuum, and injected with a needle after positioning an intramedullary plug. The survivorship of 98 implants was evaluated after 10 years. The survival rate was 98%. The Lubinus SPII prosthetic stem shows a high rate of survival. The influencing factors of this good outcome are the prosthetic design, the improvement in cementation techniques, and after all a good surgical technique.

Key words Survivorship • Hip • Total hip replacement • Cemented

Introduction

In the field of orthopaedics, one of the major successes in the last years has been total hip replacement (THR). As predicted by Charnley more than 30 years ago [1], this operation has now become practically routine with more than 800 000 THR being performed worldwide each year. However, inevitable with such a large number of applications, there is a significant occurrence of complications.

For a long time, the aseptic loosening of the prosthetic components has been considered to be the most common long-term complication of the cemented THR. In the late 1980s, many authors highlighted the presence of significant

radiolucency in 20%-30% of THR. For that reason, and because of the introduction of biological fixation THR, many surgeons abandoned cementation. Nevertheless new cementation techniques together with an evolution in the design of prosthesis have served to significantly improve the results. In 1986, Harris and McGann [2] presented a failure rate of only 1.7% after a follow-up period of 6 years following the introduction of a third generation cementation technique. In a retrospective study on 234 different cemented stems, Mulroy and Harris [3] recorded a 3% failure rate for a 10-year follow-up. More recently, Lewallen and Cabanela [4] presented a study on 152 THR with non-cemented cups, recording 2.2% cases of loosening of the cemented stem for 5-year follow-up.

A survival analysis of 92 675 different cemented THR was performed by Malchau et al. [5] in 1993. These authors demonstrated that the results varied depending on the design of the prosthesis and the cementation technique employed. The best results were attained with Charnley THR, CAD and Lubinus SP. In particular, the Lubinus stem survival rate was 99% at a 7-year follow-up. In a more recent study by Malchau and Herberts [6] on 134 056 THR, the SPII stem (evolution of Lubinus SP) had a survival rate of 93.4% over the period 1979-1986 and 97.4% from 1987 to 1996.

Materials and methods

The characteristics of the Lubinus SPII stem are as follows: a chrome-cobalt alloy smooth stem, 150-mm long, with anatomic shape corresponding to the shape of the left and right femoral canals, neck with anatomic anteversion and inclination of 135° , with the supporting section at the level of the calcar (Figs. 1, 2). A 32-mm metallic head was incorporated.

The cementation process was performed using CMW3 cement mixed under vacuum and injected in the femoral canal with the appropriate pistol and intramedullary needle before introducing the plug.

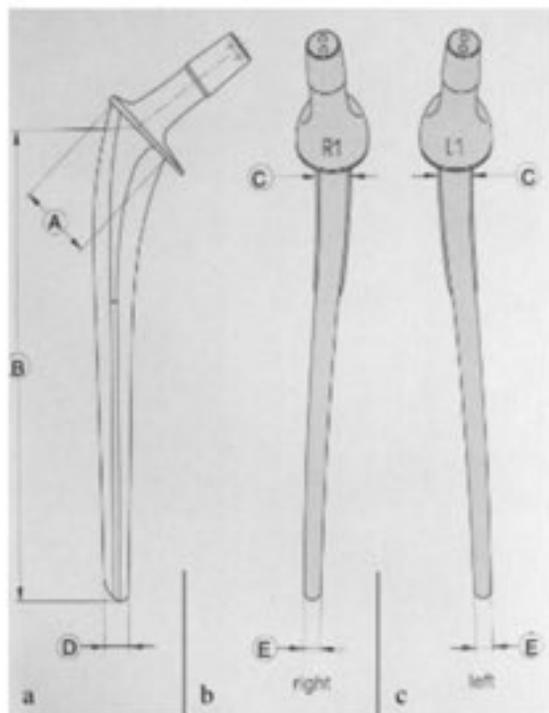


Fig. 1a-c SPII stem characteristics **a** View of the stem. Lateral view of a right **(b)** and a left **(c)** stem. **A**, proximal width; **B**, stem length; **C**, proximal thickness; **D**, distal width; **E**, distal thickness

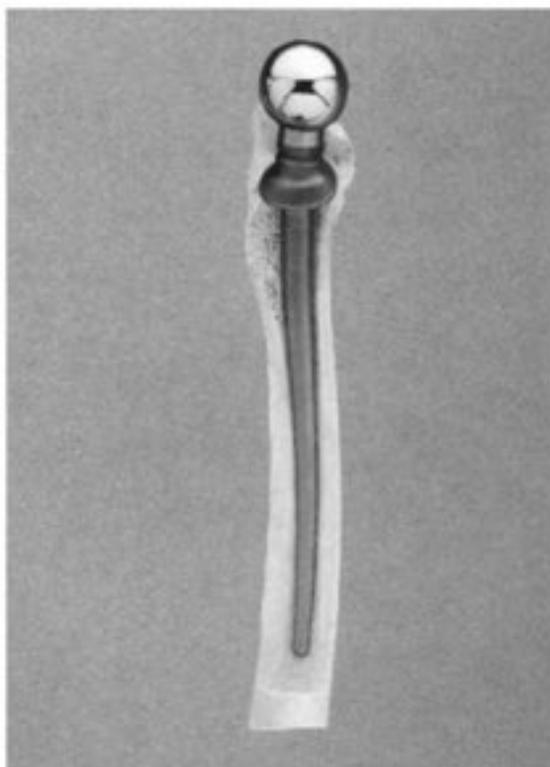


Fig. 2 Stem adaptability to the anatomical shape of the femur

Between March 1989 and October 1991, 98 stems were implanted in 32 male and 66 female patients of ages between 60 and 86 years, with an average age of 72 years. The pre-operative diagnoses were 73 cases of osteoarthritis, 17 femoral neck fractures, and 8 cases of aseptic loosening.

In 59 cases the Lubinus stems were used with a screwed cup V-Thabe (Waldemar Link), in 5 cases a press-fit Mallory-head cup (Biomet, Inc.), and in 3 cases a Muller cemented cup. In the 17 hemiarthroplasties, a biarticular head (Vario-Kopf) was adopted.

Results

Of the 98 patients originally treated, 4 died for reasons unrelated to the operation and 6 patients could not be contacted. Assuming that the 6 patients lost to the follow-up did not fail, the success rate of the operation was determined, with failures being associated to the cases in which the stems were removed as a result of secondary loosening. The data for the 98 cases considered were compiled in a Dobbs' life table (Table 1) [7]. Using Kaplan and Meier's model (Fig. 3) [8], the survival rate at the mean follow-up of 10 years was found to be 98%. In only 2 of 98 cases, a loosening of the stem occurred; the first

Table 1 Life table according to Dobbs [7] showing the number of cases, the number of reimplants, the patients withdrawn, the answer failure rate the annual success rate and the survival rate

Years since operation	Number at start	Failure	Withdrawn patients	Annual failure rate	Annual success rate (%)	Survival rate (%)
1	98	0	1 (died)	0	100	100
2	97	1	1 (died)	1.03	98.97	99
3	95	0	1 (died)	0	100	99
4	94	0	1 (died)	0	100	99
5	93	0	1	0	100	99
6	92	0	0	0	100	99
7	92	1	5	1.07	97.93	98
8	87	0	30	0	100	98
9	57	0	40	0	100	98
10	17	0	0	0	100	98

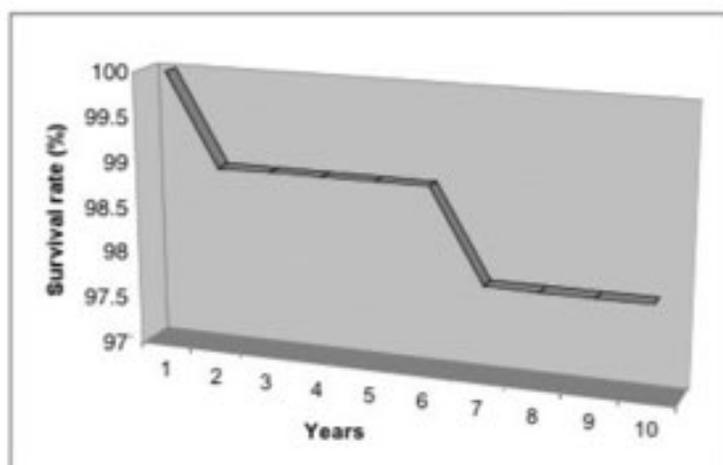


Fig. 3 SPII survival curve according to Kaplan and Meier [8]

patient, a female aged 70 years in generally poor condition, was initially operated on in 1990 and then reoperated after one year to remove the prosthesis; in the second patient, aged 62 years, an aseptic loosening of the cement at the apex of stem occurred after 7 years.

Discussion

The cemented implants developed in the mid-1980s exhibited a low revision incidence. Lubinus SPII stem demonstrated a relatively high survival rate.

The quality of the implants is related to the design of the prosthesis, to the cementation techniques employed, and to the use of an uncemented cup. The material employed, chrome-cobalt, has been validated through experimentation over many years in terms of durability, isoelasticity and

resistance to erosion at the metal-cement interface.

Its anatomic design allows good primary stability thanks to an ideal distribution of the cement on the stem (Figs. 4, 5). The neck angulation permits an offset exceeding 2.5 cm, restoring the original anatomy. In his study, Keller [9] underlined the importance of tensioning the abductor muscles that tend to contrast the pivoting motion of the stem.

As concerns the cementation technique, it is appropriate to highlight the fact that when the distribution of cement is inhomogenous or excessively thin with peripheral voids, this may facilitate secondary loosening of the stem. This concept is underlined by Harris [10] the cement mantle must not be inferior to 2.0–2.5 mm. Regarding this point, the correct proximal and distal positions are important.

Clobisly and Harris [11] in a review of 100 hybrid THR with pre-cemented non-smooth stems implanted in 86 patients recorded 4 cup and only 1 stem revisions for a 10-year follow-up.



Fig. 4 X-rays showing a hybrid implant with a SPII stem and a press-fit cup



Fig. 5 The same case as in Fig. 4. Stem view

From the studies which have been published, agreement has yet to be reached regarding the merits of the degree of smoothness and of pre-coated stems. Mohler et al. [12] proposed that such factors could be directly related to the failure rate, suggesting that better results may be attained with smooth stems.

Dowd and Cha [13] reported a high rate of failure with pre-coated stems due to the lack of protection from the irregular cemented mantle which apparently depends on the positioning and design of the stem.

The concept of a hybrid system (Fig. 6) derives from autptic studies in which Harris [10] demonstrated the different mechanism of loosening of the cup and of the stem. The cemented cup loosens for biological macrophagic erosion that causes osteolysis. The stem loosening is often related to the different distributions of the loads or to the cement porosity. Unlike stem loosening, cemented cup loosening has not demonstrated a corresponding reduction with the improvement of cementation techniques.

The results of the study described in this article can be compared with those of Mulroy and Harris [3], being related to a smaller number of cases and to a shorter follow-up period, confirming the good quality and survival of the Lubinus SPII stem.



Fig. 6 Hybrid total hip replacement with an SPII stem and a screwed V-Taber cup

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