Long-term results of the standard Wagner cup

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Abstract Cementless acetabular components gained popularity because of the increased rate of loosening associated with cemented cups after intermediate and long-term follow-up. There are few long-term follow-up studies of cementless acetabular components. This study aims to evaluate the clinical and radiological long-term results of the press-fit standard Wagner Cup. Between January 1, 1994 and June 30, 1994, 118 implantations of a standard Wagner Cup were performed, and 102 implants were clinically and radiographically followed-up after a mean of 12.0 years. The Merle d'Aubigné score improved from a preoperative mean of 9.5 to 17.2 at latest follow-up. Early postoperative complications included two deep haematomata requiring needle aspiration, two deep vein thromboses, one pulmonary embolism, two temporary lesions of the sciatic nerve, one single event of THR dislocation and one recurrent dislocation. Two isolated cup

revisions and five more complete total hip replacements were performed for aseptic loosening. The overall survival rate at 12 years was 93.1% (95/102). The standard Wagner cup yields very good long-term results.

Introduction

Cementless acetabular components gained popularity because of the increased rate of loosening associated with cemented cups after intermediate and long-term follow-up [9, 12, 16]. In studies of primary total hip arthroplasties with a minimum of ten-year follow-up, the survival rate of press-fit acetabular component shells range from 83% to 98% and 82% to 92% for the liners [1–5, 9, 10, 15, 17]. First-generation cementless acetabular components demonstrated problems associated with design related complications, implantation technique, and the manufacturing process. Increased understanding of the modes of failure, coupled with improvement in the manufacturing process, resulted in the development of second-generation cementless cups, e.g. the standard Wagner cup with fewer screw-holes (or no holes), polished inner surfaces, improved locking mechanisms, and maximal shell-liner conformity [16]. To our knowledge no long-term studies about the standard Wagner cup have been published. The aim of this study was to report the long-term results of the press-fit standard Wagner cup.

Materials and methods

The standard Wagner cup (Protek, Switzerland, now Zimmer, USA) is made from CP titanium with a wall thickness of 3 mm. The surface roughness of the gritblasted

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Wagner standard cup ranges between 40 and 60 μm . Cup sizes are available from 44 to 62 mm outer diameter in 2 mm steps. To enhance primary stability seven holes offer the possibility of additional screw fixation. The standard Wagner cup is to be used exclusively with countersunk cancellous bone screws. This 6.5 mm countersunk cancellous bone screw is made from titanium and the head has a hexagonal socket design. There are no screw openings in the distal half of the shell, ensuring that screws are not erroneously inserted transversely to the loading direction. In this area there are 13 sharp-edged pyramid-like elevations which penetrate into the cancellous bone during impaction. These elevations increase the primary stability particularly with regard to prevention of rotation and tilting, whilst at the same time offering a larger surface area for subsequent osseointegration. These pyramid-like elevations are positioned as close as possible to the cup edge, thus increasing the equatorial press-fit (Fig. 1). UHMWPE and Metasul inserts are available. One section of the rim of the poly-ethylene insert has a raised edge to lower the incidence of dislocation. This raised section can be orientated in 30° steps into any desired position before driving the insert home. The grooves in the metal shell are slightly narrower at the base so that the teeth on the polyethylene insert are firmly fixed after insertion. Only nine out of 12 grooves in the metal shell are occupied by castellations on the PE insert. The three empty grooves are placed at 120° intervals to ensure that one of these empty grooves always remains accessible after implantation. The mechanism of PE liner fixation is demonstrated in Fig. 2.

Between January 1, 1994 and June 30, 1994, 118 standard Wagner cups were used at one institution by the designer surgeon and his team. Of this patient population ten patients died, while six patients could not be contacted for follow-up examinations. To date, 102 cases were clinically and radiographically reviewed after a mean in-

Fig. 1 The Wagner standard cup

Fig. 2 The locking mechanism of the Wagner standard cup

situ time of 12.0 years (min 10, max 13.4). The average age at the time of surgery was 60.7 years (min 28, max 77). The patient cohort included 29 men and 89 women.

The indications for the implantation of the standard Wagner cup are listed in Table 1. No additional titanium cancellous bone screws were used in 14 cases, two screws in 79 cases, three screws in 24, and four screws in four cases.

On the femoral side, 59 cases were treated with the cementless cone prosthesis by Wagner, 33 with a cementless CLS stem and 26 with a cemented Müller straight stem. The bearing surfaces were polyethylene/ceramic in 25 cases, metal-on-metal in 68 cases and polyethylene/ metal in 25 cases. The femoral head diameters were 32 mm for all cases reported here.

All procedures were performed in an ultra-clean-air theatre (with antibiotic prophylaxis). During their stay in the hospital, all patients were treated with low molecular weight Heparin and compression stockings as a prophylaxis against deep vein thrombosis. For the duration of 12 weeks, partial weight bearing of 20 kg using elbow crutches was required. A clinical and radiographic follow-up examination was performed three months and 12 months after surgery and, thereafter, at annual intervals. The clinical

Table 1 Indications for total hip replacement (THR)

Indication for THR	Number
Primary osteoarthritis	80
Dysplastic coxarthrosis	24
Inflammatory osteoarthritis	2
Rheumatoid arthritis	2
Avascular necrosis	1
Fracture of the femoral neck	4
Revision arthroplasty	5
Total	118

evaluation was rated according to the Merle d'Aubigné score. Standard X-rays in anterior/posterior position as well as in a Lauenstein position were taken to assess the radiographic results. Radiolucencies in the acetabulum were rated according to DeLee, and heterotopic ossifications according to the Brooker classification.

Results

The Merle d'Aubigné score improved from a preoperative mean score of 9.5 (min 2, max 14) to a mean score of 17.2 (min 13, max 18) at the latest follow-up. Early postoperative complications included two deep haematomata requiring needle aspiration, two deep vein thromboses, one pulmonary embolism, two temporary lesions of the sciatic nerve, one single event of total hip replacement (THR) dislocation and one recurrent dislocation. Two isolated cup revisions and five more complete total hip replacements were performed for aseptic loosening.

The radiographic evaluation of the remaining standard cups revealed 11 radiolucencies in DeLee zone I, one each

in zones II and III and one in zones I–III. Thirty-five heterotopic ossifications were observed (I°: 30, II°: 2, III°: 3).

The overall survival rate at 12 years was 93.1% (95/102).

Figure 3 represents the postoperative 13-year course of a standard cup by Wagner in a case with dysplastic coxarthrosis.

Discussion

Cementless acetabular components gained popularity because of the increased rate of loosening associated with cemented cups after intermediate and long-term follow-up. To our knowledge we present the first long-term follow-up study on the standard Wagner cup with a large consecutive cohort of patients. The overall survival rate at 12 years was 93.1% (95/102). One main problem of this study is that the results cannot be extrapolated to other modular cup designs associated with different locking mechanisms, shell-liner conformities, polyethylene types, and sterilisation methods. Furthermore, this study is a retrospective study with all well known problems, compared to a prospective study. Never-

Fig. 3 **a** The anteroposterior (AP) X-ray of the right hip of a 45-year-old patient shows a dysplastic osteoarthritis of the hip. **b** The X-ray examination one week after surgery shows the implantation of a standard cup by Wagner combined with a cone prosthesis with metal-on-metal articulation. On the AP (**c**) and lateral (**d**) X-rays after 13 years, the cup is stable and osseointegrated; no radiolucencies can be detected

theless, we have demonstrated favourable results for this particular cup that should be discussed with the current literature. The use of cementless acetabular components has resulted in excellent long-term clinical results and is currently preferred for acetabular reconstruction. In studies of primary total hip arthroplasties with a minimum of ten-year follow-up, the survival rate of the press-fit acetabular component shells range from 83% to 98% and 82% to 92% for the liners [1–5, 7, 9–11, 15, 17]. These clinical results compare favourably with those of cemented acetabular components, where reports of revision as high as 10–20% and loosening rates of 20–40% at long-term follow-up have been reported. Prosthetic design, implant material, and degree of initial stability determine the extent of biological fixation and ingrowth that can occur with press-fit acetabular components. Initial stability is crucial (greater than 150 micrometers of micromotion can lead to formation of a fibrous membrane at the bone prosthesis junction [12]) for establishing bony ingrowth and can be achieved in several ways with pegs, screws, spikes, press-fit fixation, or with a combination of these modalities. Many of the previously noted studies employed supplemental fixation via screws or pegs to augment initial component stability [12].

Valle et al. [12] published good results with the Trilogy cup with a low rate of revision for aseptic loosening (0.3%) and a low rate of periprosthetic osteolysis (5%). In this study a good or excellent clinical result with retention of both components was observed in 97% (264) of 271 patients who were still alive at the time of the last follow-up.

We concur with Russell et al. [14] that second generation cementless cups in total hip replacement lead to excellent results in comparison to first generation ones. In his retrospective study he found a 96% survivorship at a mean of 9.5 years.

Recently, Nakoshi et al. [13] published long-term results on the Harris-Galante porous II (HGPII) cup with a bad survivorship 13 years after surgery (78%) which was related to a small 22-mm head and failure of the locking mechanism. In our series a 32-mm head was used in all cases.

Additional screw fixation was performed in all but 14 cases to increase initial stability of the cementless standard Wagner cup.

Many studies have found that bone screws are very helpful aids for cup fixation, but the optimal surgical technique for inserting screws has not been clearly reported. Hsu et al. [8] could demonstrate that an increasing number of screws enhances the cup stability in the case of ideal screwing (i.e., with no eccentricity). An angular eccentricity of 15 degrees did not affect the cup stability for fixation with one or two screws. However, the presence of 25 degrees of angular eccentricity significantly reduced the

stability of the cup, while 1 mm of offset eccentricity produced an even greater impact.

Farizon et al. [6] published a cumulative survival rate of 95.4% at ten and 12-years follow-up for an alumina-coated hemispherical cup without holes. There was no evidence of osteolysis at the bone-cup interface in normally functioning implants. Farizon et al. postulated that their results confirmed that cementless hemispherical cups survive well, and they demonstrate the value of cups without holes for screws which can allow migration of polyethylene particles which might induce osteolysis of the adjacent ilium.

Significant rates of osteolysis have been found using cementless acetabular components, ranging from 4% to 76% in primary total hip arthroplasties [12]. In our study we found no osteolysis in the non-revised cases but 13.7% had non-progressive radiolucent lines. Zicat et al. [18] have shown that areas of osteolysis around press-fit acetabular components tend to be localised and expansive. Despite large osteolytic areas, patients are typically asymptomatic until component migration or fracture of the acetabulum occurs. Therefore we strongly recommend regular (one to two years) clinical and radiological follow-ups.

We conclude that the standard Wagner cup yields very good long-term results. The standard cup offers the possibility of additional screw fixation. In this study we found no differences in cases with or without additional screw fixation in the long-term follow-up. We concur with Engh et al. [5] that porous-coated cups fixed with spikes or by press-fitting the component with or without screws can provide durable fixation.

In view of the good long-term results of the cementless standard Wagner cup, we are still using this implant. Meanwhile, we have modified our operative technique and use no screws or a maximum of two additional screws and have found no differences in the outcomes.

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