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ORIGINAL PAPER

Total hip replacement with an uncemented Wagner cone stem for patients with congenital hip dysplasia

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Abstract
Purpose The purpose of this study was to review retrospectively the cases operated upon in our department in recent years with a Wagner stem and a small socket in cases of Crowe I or II dysplastic hips.
Methods We conducted a retrospective clinical radiological review of 30 hips diagnosed with hip dysplasia Crowe I or II treated in our centre between 2002 and 2008. All of them were treated with a Wagner cone stem and a small Trilogy acetabulum (Zimmer ®).
Results There were 15 men and 11 women with 13 left and 17 right femurs. Mean follow-up was 43.44 months (range 14–87). Eight patients were Crowe I type and 22 were Crowe II type. Merlé d'Aubigne score pre-operatively was 12.23 and at the last follow-up was 15.54. Mean leg length inequality was 1.79 and after surgery it was 0.69 cm. Complications included three infection and three dislocations (two of them in the same patient).
Conclusions The use of a Wagner stem is a good option to correct the different deformities in the proximal femur in these cases. A small socket allows a correct relocation of the acetabulum in a dysplastic socket with good bone coverage.

Background

Planning total hip arthroplasty in a patient with osteoarthritis secondary to congenital dysplasia is a challenge for an orthopaedic surgeon. A dysplastic acetabulum, an over anteverted femoral hip and a displaced centre of hip rotation are some of the difficulties to be found during surgery [1, 2]. The centre of rotation in dysplastic hips is lateralised, increasing the body weight lever arm over a smaller contact area due to poor coverage of the femoral head [3]. Reconstruction of an over shallow acetabulum can be achieved using an uncemented or cemented socket placed in the native acetabulum. In some cases lateral supplements (biological or not) or an osteotomy may be needed in order to place it correctly.

A hypoplastic femur, a narrow canal with a short and valgus neck are some of the multiple femoral abnormalities in these patients [4]. The use of a conventional stem (cemented or uncemented) may be impossible in some of these cases.

When planning a total hip arthroplasty (THA) in an arthritic hip secondary to a dysplasia, these abnormalities must be taken into account.

Possibly in Crowe type I dysplastic hip [5] a conventional prosthesis may sometimes be used, but not in most cases of advanced Crowe type II dysplastic hips.

In 2002, we began to perform joint replacements in dysplastic hips (Crowe I and II) using an uncemented Wagner Cone Prosthesis Hip Stem (Zimmer ®) and a small size Trilogy Acetabular System (Zimmer ®). This acetabulum, normally used in non-dysplastic hips, is placed at or near the anatomical position of the centre of rotation of the hip, to restore its anatomical place. More advanced dysplastic hips may need a modification of the acetabular bone stock and were not included in the study. The stem used is uncemented and it was initially designed to be placed in femora with anatomical deformities. Its design allows the stem to be placed in the position desired, restoring its normal anteversion.

In this study we report the outcomes of the dysplastic hips, Crowe I and II, treated with the uncemented Wagner

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Cone Prosthesis Hip Stem (Zimmer ®) and with a small size Trilogy Acetabular System (Zimmer ®) from 2002 to 2008 in our hospital (Figs. 1 and 2).

Material and methods

Patient demographics

A retrospective study including 30 hips in 26 consecutive patients with osteoarthritis secondary to dysplastic hip types I and II of Crowe classification was performed. All patients underwent total hip arthroplasty using an uncemented Wagner Cone Stem (Zimmer ®) and a Trilogy Acetabular System (Zimmer ®) between September 2002 and October 2008. All operations were performed by one of the members of the hip team (C. M.C, F.M.L. or A.L.G). The mean duration of follow-up was 43.44 months (range 14–87).

A radiographic plan was done in all patients including a telemetry study, anteroposterior pelvic view and a true lateral view. Dysplastic hips were classified by the Crowe system (22 Crowe type II and 8 Crowe I dysplastic hips).

Surgical technique and implant

All patients received antibiotic prophylaxis (cephazolin 2 g 30 minutes prior to the surgery and 1 g every eight hours during the 24 hours post surgery) and low molecular weight heparin perioperatively in order to prevent deep vein thrombosis. An anterolateral approach described by Hardinge was used in all patients. In no case was a trochanteric osteotomy was performed. After capsulotomy, we confirmed the position of the femoral head in relation to the acetabulum. Following this, the hip was dislocated and the femoral head removed.

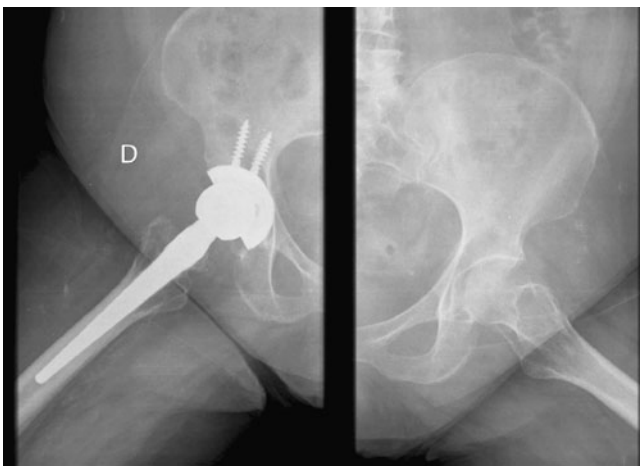

Fig. 1 The uncemented Wagner Cone Prosthesis Hip Stem (Zimmer ®) and a small size Trilogy Acetabular System (Zimmer ®)

In order to restore the centre of hip rotation, it is important to use a small socket [6]. The superior part of the acetabulum was reamed, setting the socket in its superior part, lowering and medialising the centre of rotation of the hip. In one case a superior metal trabecular supplement was needed due to a larger superior bone defect than expected from the preoperative plan.

The main problem in the femur, as noted previously, is the excessive anteversion of the femoral neck. The use of the uncemented Wagner Cone Prosthesis Hip Stem (Zimmer ®) allowed us to achieve a correction of the femoral neck version. The conical design of the stem and the eight longitudinal ribs provide good rotational stability. A grit-blasted titanium surface provides a good press-fit. The prosthesis has a 135° neck shaft angle reproducing the anatomical head centre and a 12/14 taper compatible with several femoral heads.

Follow-up and radiographic analysis

Pre-operatively, a clinical and radiographic evaluation was done. For the clinical evaluation, the Merle d'Aubigné and Postel [7] score was used. For the radiographic analysis, an anteroposterior view of the pelvis, a true lateral view of the affected hip and a telemetric view of the lower extremities were done. A computer system—Picture Archiving and Communication System (PACS)—was used for this analysis. The dysplastic hips were classified according to the Crowe classification, dividing the hip dysplasia in to four degrees based on the extent of proximal migration of the femoral head: type I, less than 50% of subluxation; type II, 50–75% of subluxation; type III, 75–100% of subluxation; and type IV, more than 100% of subluxation. The abduction angle and the leg length discrepancy in the preoperative and postoperative periods were measured. Radiographic signs of loosening were recorded too. For the clinical evaluation the widely used Merle d'Aubigné and Postel score was performed.

Results

The mean follow-up after surgery was 43.44 months (range 14–87). The main preoperative Merle d'Aubigné and Postel scores were 4.41 for pain, 4.17 for mobility and 3.65 for function (total 12.23). The main postoperative Merle d'Aubigné and Postel scores were 5.51 for pain, 5.17 for mobility and 4.86 for function (total 15.54).

The mean correction of limb length was 1.1 cm (range 0.5–2.2) (comparing length before operation and at the last follow-up radiology). The main pre-operative discrepancy was 1.79±1.25 and the postoperatory discrepancy was 0.69±1.17. The mean abduction angle of the socket was 41° (range 33–

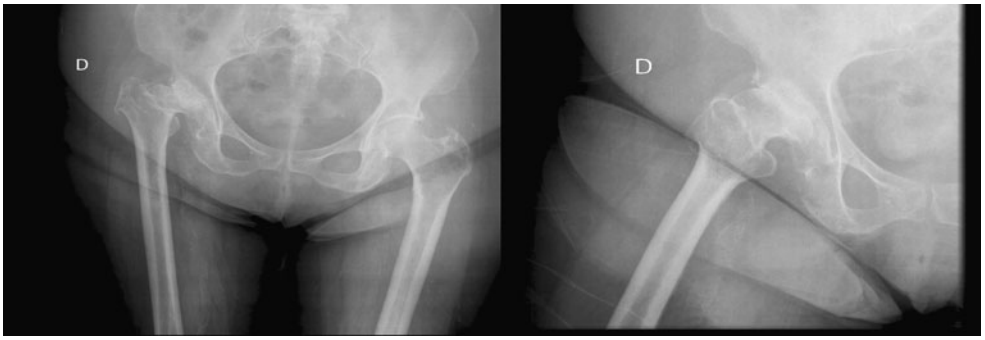

Fig. 2 An AP and Axial x-ray of a Crowe type I dysplastic hip

54°). No signs of loosening were seen at minimal follow-up of 14 months (mean 43.44 months).

Complications in the postoperative period occurred in five patients. These complications were three dislocations and three infections (one of the patients had both complications). One patient suffered recurrent dislocations, for gluteus muscle damage and was treated with a retentive socket. After a year without dislocations, one patient was diagnosed with prosthetic infection and treated by two-stage replacement. In this second stage another retentive socket was used for the soft tissue weakness in order to prevent more dislocations. After two years follow-up, there were no signs of infection in this patient. The three cases of prosthesis infections resolved after two-stage hip replacement. The other two cases of dislocation were treated by reduction under sedation and a one-stage replacement respectively.

Discussion

Several treatments have been used for treating hip arthritis secondary to a dysplastic hip [8–10], but few studies consider the Wagner stem as a possibility. Professor H. Wagner designed this stem in 1990 for patients with proximal femur deformities. The use of specifically designed components for the dysplastic femur has been encouraging for the treatment of this abnormality [11–13]. A rigorous preoperative plan is needed in order to ensure a good result. The conical stem used in these cases allows good correction of the over anteverted neck, and the eight-ribs design provides good rotational stability, comparable to a conventional cemented or uncemented stem [14, 15].

Kobayashi et al. [16] and Freeman et al. [17] argued in their studies that 95% of ten-year prosthetic survival can be predicted at the two-year follow-up as long as there are no radiolucent lines ≥2 mm around the prosthesis and it has not migrated ≥2 mm distally. In our study, with the exception of the infected hips, to date no signs of loosening have been seen in the radiological study with a minimum follow-up of 14 months (mean follow-up 43.44 months).

Pak et al. [12] revised 26 cone stems placed in dysplastic hips with good results. They did not describe any cases of dislocation or deep infection, our most important complications, after 50 months of follow-up. There are very few studies, as far as we know, treating dysplastic hips with this type of stem.

The cases of dislocations may be related to the difficulties in obtaining correct anteversion of femoral neck in some cases, together with the orientation of the acetabulum and with the affected soft tissues, which provide insufficient muscle strength to the hip. Our three cases of dislocation were some of the firsts cases operated upon with these implants in our department, with the learning curve as a probable reason for the high rate of this complication. Moreover, the increased offset of this stem could be related to these dislocations.

Recently, Schuh et al. [18] presented a large series of 93 patients treated using this kind of stem with very good results at 11 years of follow-up. Bruzzone et al. [19] reported a retrospective evaluation of 87 patients who were operated upon using the ABG total hip prosthesis with a 99% survival rate for the stem and 90% for the cup. Baker et al. [20] also presented good results with this stem, although there was a 17% rate of periacetabular osteolysis at 15 years.

We agree with Spangehl et al. [21] who prefer to medialize the socket without fracture of the medal wall and without graft in dysplastic hip Crowe types I and II. For higher types of dysplastic hips, he recommend a structural bone autograft and use of an uncemented socket. Delimar et al. [22] developed a new reconstruction method using a pedicle iliac graft after verifying that the deep circumflex artery was long enough to transfer this graft without resorting to micro-vascular anastomosis. Rozkydal et al. [23] reported 43 cases of dysplastic hips treated with a CLS Expansion shell and a structural femoral head autograft. These options may be of interest when there is deficient acetabular bone stock in order to place the socket in its anatomical centre of hip rotation.

We conclude that the cone femoral stem is a good solution in dysplastic hips and allowing placement of the stem in the anteversion desired without the necessity of

cement. A small socket allows medialisation and lowering of the centre of rotation of the hips. This combination is a good and inexpensive solution for cases of Crowe type I and II dysplastic hips.

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