The Journal of Arthroplasty 30 (2015) 827–834

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Femoral Revision Using the Wagner SL Revision Stem: A Single-Surgeon Experience Featuring 11–19 Years of Follow-Up

Ali Baktır, MD [a], Fatih Karaaslan, MD [b], Kürşat Gencer, MD [c], Sinan Karaoğlu, MD [d]

[a] Department of Orthopaedics and Traumatology, Modern Dünya Hospital, Kayseri, Turkey
[b] Department of Orthopaedics and Traumatology, Bozok University Faculty of Medicine, Yozgat, Turkey
[c] Department of Orthopaedics and Traumatology, Kayseri Training Hospital, Kayseri, Turkey
[d] Department of Orthopaedics and Traumatology, Memorial Kayseri Hospital, Kayseri, Turkey

ARTICLE INFO

Article history:
Received 21 July 2014
Accepted 22 December 2014

Keywords:
hip arthroplasty
femoral revision
Wagner SL Stem
extended trochanteric osteotomy
clinical outcome

ABSTRACT

Seventy-four revisions of the femoral component featuring placement of a Wagner stem in 74 patients operated upon between 1995 and 2003 were reviewed. Clinical evaluation, radiological assessment, and survival analysis of revision stems were conducted. The mean follow-up duration was 14.4 years (range, 11 to 19 years). When failure was defined as stem removal for any reason, 4 of 64 stems had to be further revised during the follow-up period, yielding a cumulative stem survival rate of 93.8% (95% CI: 87.7% to 98.2%) at 18 years. The Wagner revision stem is an effective implant for revision hip surgery when bone stock is lacking. Use of the stem affords mechanical stability even when bone loss is massive.

Femoral reconstruction during revision total hip arthroplasty (THA) is formidably difficult when osteolysis has triggered massive loss of bone stock in the proximal femur [1,2]. In such a situation, cemented components exhibit high failure rates and impaction bone grafting is technically demanding [3]. Therefore, restoration of bone stock has been thought to be necessary to ensure long-lasting results. Various biological reconstruction techniques for the proximal part of the femur are available. As the extent of autogenous bone grafting is limited, allografts are used widely.

Reconstructive options include the use of cemented long stems, uncemented stems featuring diaphyseal fixation distal to the defective zone, allograft reconstruction (with structural or intraluminal cancellous allografts [4,5]), and Girdlestone resection arthroplasty.

In 1987, Wagner described a technique featuring fixation of a cementless long-stem prosthesis in the diaphysis, and reported excellent spontaneous osseous regeneration. The Wagner femoral component is a straight but tapering stem, to which flutes are affixed to allow of immediate diaphyseal fixation [6] (Fig. 1). The stem has a rough titanium surface to facilitate long-term biological fixation. Excellent spontaneous bone regeneration accompanied by early restoration of bone stock has been described in studies featuring mid-term and long-term follow-up [7,8].

The purpose of this retrospective study was to present my long-term clinical and radiological experience with the cementless, distally fixed, Wagner Self-Locking (SL) stem (Sulzer Orthopedics Ltd, Winterthur, Switzerland) used for femoral revision surgery, with a focus on peri-operative and post-operative problems and the durability of implant fixation.

Materials and Methods

Between 1995 and 2003, 74 Wagner SL revision stems were implanted (without cement) in 74 patients by a single surgeon. Ten patients who did not fulfill the inclusion criteria were excluded, and a minimum 10-year duration of clinical and radiographic follow-up was required for inclusion. Five patients were lost to follow-up (5 hips) and five died of causes unrelated to their operation (5 hips) before the 10 years had passed. The remaining 64 hips (64 patients) were analyzed (Table 1). Of the 64 patients, 41 were female and 23 male, and mean patient age at the time of operation was 65.5 years (range, 48–87 years). The mean follow-up time for the 64 living patients who did not need further stem revision was 14.4 years (11–19 years); no patient was lost to follow-up. All 64 surviving hips were subjected to clinical and radiological assessment (Figs. 2 and 3). The diagnoses prior to primary THA were osteoarthrosis in 46 patients, aseptic necrosis in 2, rheumatoid arthritis in 3, dysplasia in 6, post-traumatic arthrosis in 2, and proximal femoral fractures in 5. The main indication for revision was severe proximal femoral bone loss with symptomatic aseptic loosening in 36 hips; the remaining hips were revised because of septic loosening of the stem in 11 cases, periprosthetic fracture of 6, subtrochanteric nonunions after femoral shortening osteotomy in 6, and mechanical failure with broken implants in 5 (Fig. 4). Seventeen of the revisions involved replacement of a cemented stem. The procedure constituted the first revision of 60 hips, the second in 3, and the third in 1. Forty-nine hips required both femoral and acetabular revision, but the other 15 femoral stem revision only.

No author associated with this paper has disclosed any potential or pertinent conflicts which may be perceived to have impending conflict with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2014.12.024.

Reprint requests: Dr. Fatih Karaaslan, MD, Ortopedi ve Travmatoloji AD, Bozok Universitesi Tip Fakültesi, Yozgat, TR-66200, Turkey.

http://dx.doi.org/10.1016/j.arth.2014.12.024
0883-5403/

Fig. 1. Wagner SL prothesis.

Severe bone loss was defined as cortical thinning with or without defects, affecting the proximal femur to the extent that solid durable fixation of a short-stemmed cemented component was not possible. Defects were classified using the Paprosky system [9], as follows: type 1 in 12 hips, type 2 in 22, type 3A in 17, type 3B in 11, and type 4 in 2.

The Wagner SL revision stem, featuring use of a biocompatible TiAlNb alloy with a rough-blasted surface, carries eight longitudinal flutes located along a straight tapered shaft. Cementless fixation is assured by securing the stem axially in a conically reamed, intact, distal femoral shaft. The shaft of the prosthesis has a conus angle of 2° and the eight longitudinal ridges are arranged in a circle around the stem. The stem is available in lengths from 190–385 mm. Cementless anchoring of the stem is achieved after implantation in a conically reamed femoral shaft. The longitudinal ridges render rotational stability eminently possible. If larger defects are evident in the proximal part of the femur, stable fixation of the stem can be achieved only distally, thus in the diaphyseal femoral region [10].

All hips were templated preoperatively to determine appropriate stem widths. Planning of operations with choice of appropriate stem size included determination of a fixation depth of at least 10 cm in intact distal diaphyseal bone [8,10,11], especially when periprosthetic femoral fractures were present. The shortest stem affording adequate biomechanical stability was used.

All operations were performed with patients in the lateral decubitis position, via a posterolateral approach under spinal or epidural combined anesthesia. Exposure of 27 hips was achieved via Extended proximal femoral (trochanteric) osteotomy as described by Younger et al [12].

Cerclage wires were used for osteotomy fixation after removal of (failed) implant components, cement, and intramedullary granulomatous tissue. The bone defect was visualized and palpation was used to assess available healthy bone stock prior to manual femoral reaming; the Wagner stem was next implanted. Supplementary bone grafts were used to treat 15 hips.

Thromboprophylaxis featured administration of low-molecular-weight heparin following a strict protocol promulgated by our Hematology Department, until patients were fully mobile. Antibiotic prophylaxis featured intravenous cefazolin sodium administered immediately prior to operation, and also at 1 g every 6 h daily for 4 days postoperatively, with intramuscular gentamicin sulfate (160 mg once daily) for 2 days. To prevent heterotopic ossification, nonsteroidal anti-inflammatory agents were given to all patients. As anesthesia wore off (usually by the evening of the operation) patients commenced static quadriceps and abductor-strengthening exercises. Passive range-of-movement exercises began one day after operation, and partial weight-bearing exercises 2–3 days after surgery.

An abduction pillow was used for 5 days. Patients who could perform partial weight-bearing exercise with two crutches were discharged to their homes. No external bracing was applied. Patients were told to minimize loading of the revised hip for at least 2 months, commencing with 30 kg of load, increasing by approximately 15 kg per week. Full weight-bearing was allowed 4–6 months post-operatively.

Clinical examination featured pain grading, and assessment of hip mobility and movement using the Harris hip score (HHS) [13] with reference to the Merle D'Aubigne and Postel scale (the values ranged from 1 to 6) [14]. Clinical failure was defined as a need for re-revision, pain of level 4 or less, or both indications. Thigh pain was considered to reflect problems with the femoral stem [8]. Any between-leg length discrepancy >1 cm was noted.

Standard anteroposterior and lateral radiographs of the pelvis and the operated femur were acquired for all patients immediately after the operation; at 3, 6, and 12 months; and annually thereafter. All postoperative and follow-up radiography was performed at our institution, using identical protocols. Each patient was placed in the supine position, with the feet together. The X-ray tube was positioned over the symphysis pubis 1 m from and perpendicular to the table. To reduce interobserver error, all patients were evaluated radiographically and clinically by an independent investigator (SK) who was not a staff member of the Department. Variations in magnification were corrected using the known diameter of the femoral head as an internal reference. The center of the femoral head and the interteardrop line were used to define the height and the horizontal location of the hip center. The obturator foramina were used as references if the teardrops were not visible [15,16]. Stem fixation was graded as stable (no progressive migration of the implant and minimal or no formation of a radio-opaque line around the stem); fibrous but stable (no progressive migration of the stem or extensive radio-opaque line formation); or unstable (progressive subsidence or migration with development of divergent radiolucent lines surrounding the stem).

Immediate post-operative and follow-up radiographs were compared to assess bone regeneration. Remodeling of the proximal femur was classified using the criteria of Kolstad et al [11] as A (developing defects), B (stable defects), or C (osseous restoration); and the cortical index values of Callaghan et al [17] were also noted. Bone quality and restoration of the proximal femoral region were quantitatively assessed on follow-up anteroposterior and lateral radiographs by measuring the widths of cortical and cancellous bone and the outside diameter of the femoral shaft at a point 1 cm distal to the inferior margin of the lesser trochanter. The entire bone mass value was calculated, as a measure of bone quality, as was the ratio of bone width to the outside diameter.

Implant migration was assessed by measuring subsidence of the femoral component using the method of Callaghan et al [17]. Subsidence was not considered to be significant if it was <10 mm [11]. Allografts were assessed in terms of incorporation into host bone by evaluation of trabecular bridging of the host-graft interface. A clear reduction in density, or breakdown of transplanted bone, was considered to reflect bone resorption. Heterotopic ossification was graded using the criteria of Brooker et al [7,18]. Pre-operative and post-operative patient satisfaction levels were subjectively graded as very content, content, intermediate, discontented but tolerant, and extremely discontented.

Statistical Analysis

Kaplan–Meier survivorship analysis was used to estimate the cumulative probability of non-revision of the femoral stem (for any reason) in all 64 hips. The failure criteria were removal of the stem because of aseptic loosening, removal of the stem for any reason, and (the worst case) removal of the stem for any cause and/or femoral stem migration ≥ 10 mm. All survivorship data are reported with 95% confidence intervals (CIs) [19].