

HINGE TOTAL KNEE REPLACEMENT REVISITED

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OBJECTIVE: To determine if aseptic loosening is a major problem in hinge total knee replacement.

DESIGN: A cohort study.

SETTING: A university-affiliated institute, specializing in elective orthopedic surgery.

PATIENTS: Fifty-eight patients, mainly those requiring revision, in whom the conditions were such that it was felt only a totally constrained implant was appropriate. In 7 patients the implant was press-fitted; in the remainder it was cemented. Five patients required fusion or revision, and 8 died less than 2 years after implantation, leaving 45 for review. Follow-up was 2 to 13 years.

INTERVENTION: Total knee replacement with a Guepar II prosthesis.

MAIN OUTCOME MEASURES: Radiolucency determined by the Cameron system and clinical scoring using the Hospital for Special Surgery system.

RESULTS: Of the cemented components, 91% of femoral stems were type IA (no lucency), 9% were type IB (partial lucency), with no type II or III lucency. Tibial lucency was 87% type IA and 13% type IB, with no type II or III lucency. Of the noncemented components, 58% of femoral components were type IA and 42% type IB. Tibial lucency was 71% type IA and 29% type IB. Lucency was mainly present in zones 1 and 2 adjacent to the knee. Clinical rating was 18% excellent, 20% good, 20% fair and 42% poor. Postoperative complications included infection (13%), aseptic loosening (7%), quadriceps lag (16%) and extensor mechanism problems (16%).

CONCLUSIONS: Aseptic loosening is an uncommon problem in hinge total knee replacement. The complication rate in cases of sufficient severity as to require a hinge replacement remains high. Current indications for a hinge prosthesis are anteroposterior instability with a very large flexion gap, complete absence of the collateral ligaments and complete absence of a functioning extensor mechanism.

OBJECTIF : Déterminer si le descellement aseptique pose un problème important dans l'arthroplastie totale du genou.

CONCEPTION : Étude de cohortes.

CONTEXTE : Établissement affilié à une université, spécialisé en chirurgie orthopédique élective.

PATIENTS : Cinquante-huit patients, surtout ceux qui avaient besoin d'une révision, dont la condition était telle qu'on a jugé que seule une prothèse avec contrainte totale convenait. Chez 7 patients, la prothèse a été ajustée sous pression. Chez les autres, elle a été cimentée. Cinq patients ont eu besoin d'une fusion et d'une révision et 8 sont morts moins de 2 ans après l'implantation de la prothèse, ce qui en a laissé 45 pour la révision. Le suivi a varié de 2 à 13 ans.

INTERVENTION : Arthroplastie totale du genou avec prothèse Guepar II.

PRINCIPALES MESURES DES RÉSULTATS : Transparence aux rayons X déterminée par le système Cameron et évaluation clinique au moyen du système de l'hôpital pour interventions chirurgicales spéciales.

RÉSULTATS : Parmi les pièces cimentées, 91 % des tiges fémorales étaient du type IA (aucune transparence), 9 % étaient du type IB (transparence partielle) et il n'y avait aucune transparence de type II ou III. La transparence tibiale était de 87 % dans le cas du type IA et 13 % dans celui du type IB et il n'y avait aucune

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transparence de type II ou III. Parmi les pièces non cimentées, 58 % des pièces fémorales étaient de type IA et 42 % de type IB. La transparence tibiale était de 71 % dans le cas des pièces IA et de 29 % dans celui de type IB. Il y avait transparence surtout dans les zones 1 et 2 adjacentes au genou. Les évaluations cliniques ont été les suivantes : excellent, 18 %, bon, 20 %, moyen, 20 % et médiocre, 42 %. Parmi les complications postopératoires, mentionnons l'infection (13 %), le descellement aseptique (7 %), une phase de latence du quadriceps (16 %) et les problèmes du mécanisme extenseur (16 %).

CONCLUSIONS : Le descellement septique est un problème peu fréquent dans les cas d'arthroplastie totale du genou. Le taux de complication dans les cas suffisamment graves pour entraîner un remplacement de l'articulation demeure élevé. Les indications courantes pour l'implantation d'une prothèse de l'articulation sont l'instabilité antéropostérieure avec un écart très important à la flexion, l'absence totale des ligaments collatéraux et l'absence totale du mécanisme extenseur fonctionnel.

In a previous review of hinge total knee arthroplasty used as a salvage procedure,¹ the outcome exceeded expectations, with a low incidence of loosening. Some of the earlier indications for hinge prostheses with very long stems have been superseded by the introduction of modular stem extensions for routine knee arthroplasty and the advent of intermediate stabilized implants such as posterior stabilized and constrained condylar prostheses for those who have had a prior patellectomy. Nonetheless, there are occasionally cases in which a hinge is the only reasonable choice of implant. More than 50 hinged implants have been inserted over the last 15 years, so a further review is appropriate to see if the previous outcome¹ could be confirmed and to follow-up the original patients.

PATIENTS AND METHODS

All patients having Guepar II hinged implants (Benoit-Gerrard Company, Caen, France) inserted by the senior author (H.U.C.) have been followed up annually whenever possible by clinical and radiologic methods. Clinical assessment was by the Hospital for Special Surgery (HSS) score,² and radiologic assessment was by a previously described method,¹ which, briefly, is as follows: type IA — no lucency, type IB — partial lucency, type II — complete lucency, the lines being parallel to the stem, and type III — complete lucency with divergent

lines. For the purpose of this study, the x-ray films were reviewed by an independent assessor (D.V.).

Patients

There were 58 patients (18 men, 40 women), 4 of whom had bilateral implants. The patients ranged in age from 41 to 84 years, 2 were under 50 years old, 5 under 60 and the majority 70 years or older. Only 1 patient had not previously undergone knee surgery. She had a globally unstable knee resulting from poliomyelitis. Two patients had nonunion of a high tibial osteotomy, and 2 had nonunion of supracondylar fractures. Four knees had been fused. Eleven patients had undergone a tibial osteotomy and 8 a patellectomy. Nineteen patients had had a single total knee replacement, 17 had undergone 2 total knee replacements, 7 had undergone 3 total knee replacements, and 1 had had 4 total knee replacements. Nine of the previous total knee replacements had had significant constraint, including 3 hinge prostheses, 2 spherocentric prostheses and 4 constrained condylar knee prostheses. Follow-up was 2 to 13 years (mean 4.2 years).

Preoperative complications included sepsis in 8 patients, patellar avascular necrosis in 8, patellar dislocation in 6 and supracondylar fracture in 6.

Indications for hinge prostheses

The indications for a hinge with a

very long stem were varied and often there were 2 or more relative indications. These included the following: nonunion in 4 patients (femur in 2 and tibia in 2); a shattered femur in 1 patient; lateral rotational dislocation of a total knee prosthesis in 3 patients; an absent medial collateral ligament in 4 patients; a huge gap, usually in flexion, requiring more than 30 mm of polyethylene in 12 patients (Figs. 1 and 2); bone loss and ligament instability in 9 patients; an L-shaped tibia with platform overhang as a result of previous high tibial osteotomy in 2 patients; a tibial diaphyseal slot required for previous tibial component removal in 1 patient; absent patella with fusion in 4 patients; previous hinge/constrained condylar knee prosthesis in 9 patients; and reflex sympathetic dystrophy in 2 patients. (As both had no relief from lumbar sympathetic blocks and had a well-functioning Guepar II prosthesis on the other side, they were convinced that a hinge implant would solve their problem. In fact it did not, reinforcing the belief that the treatment of reflex sympathetic dystrophy should be nonsurgical.)

Operative details

Noncemented press-fit fixation was adopted in 7, mainly septic, cases. In 2 cases, the tibia only was press-fitted because a linear fracture occurred during canal preparation. Fifty-one implants were cemented by standard techniques (i.e., canal plugging at the stem tip, water pick, canal brushing

and pressure injection of the cement). The original polyethylene patella was left in place in 4 cases. In 10 cases, a press-fit all-polyethylene patella was used and in 1 case a noncemented metal back patella was used. In 22 cases, a patelloplasty was done, trimming the patella to match the trochlea.

Intraoperative complications included 2 longitudinal tibial fractures, fat embolism in 1 press-fit case and 1 shattered femur during attempted previous implant removal. Twenty-four patients required a lateral retinacular release.

Exclusions

Five patients required knee fusion

or revision to a non-Guepar prosthesis and 8 were lost to follow-up, mainly through death within 2 years of the index operation. This left 45 patients for review. Six others had also died, but because the follow-up was longer than 2 years and they had a functioning knee at the time of death, they were included in this review.

RESULTS

Radiologic assessment

In the cemented components, femoral lucency was 91% type IA and 9% type IB, with no cases of type II or type III. Tibial lucency was 87% type IA, 13% type IB, with no cases of type

II or type III. Of the 7 noncemented cases, femoral lucency was 58% type IA and 42% type IB. Tibial lucency was 71% type IA and 29% type IB. Lucency when present was mainly in zones 1 and 2 adjacent to the knee.

Clinical assessment

Using the HSS rating system, we found that the results were 18% excellent, 20% good, 20% fair and 42% poor. This is not a true reflection of the knee itself as most patients had significant comorbidities that considerably lessened the function score. Pain score was as follows: no pain in 58% of patients, minimal pain not requiring analgesics 16%, mild pain re-

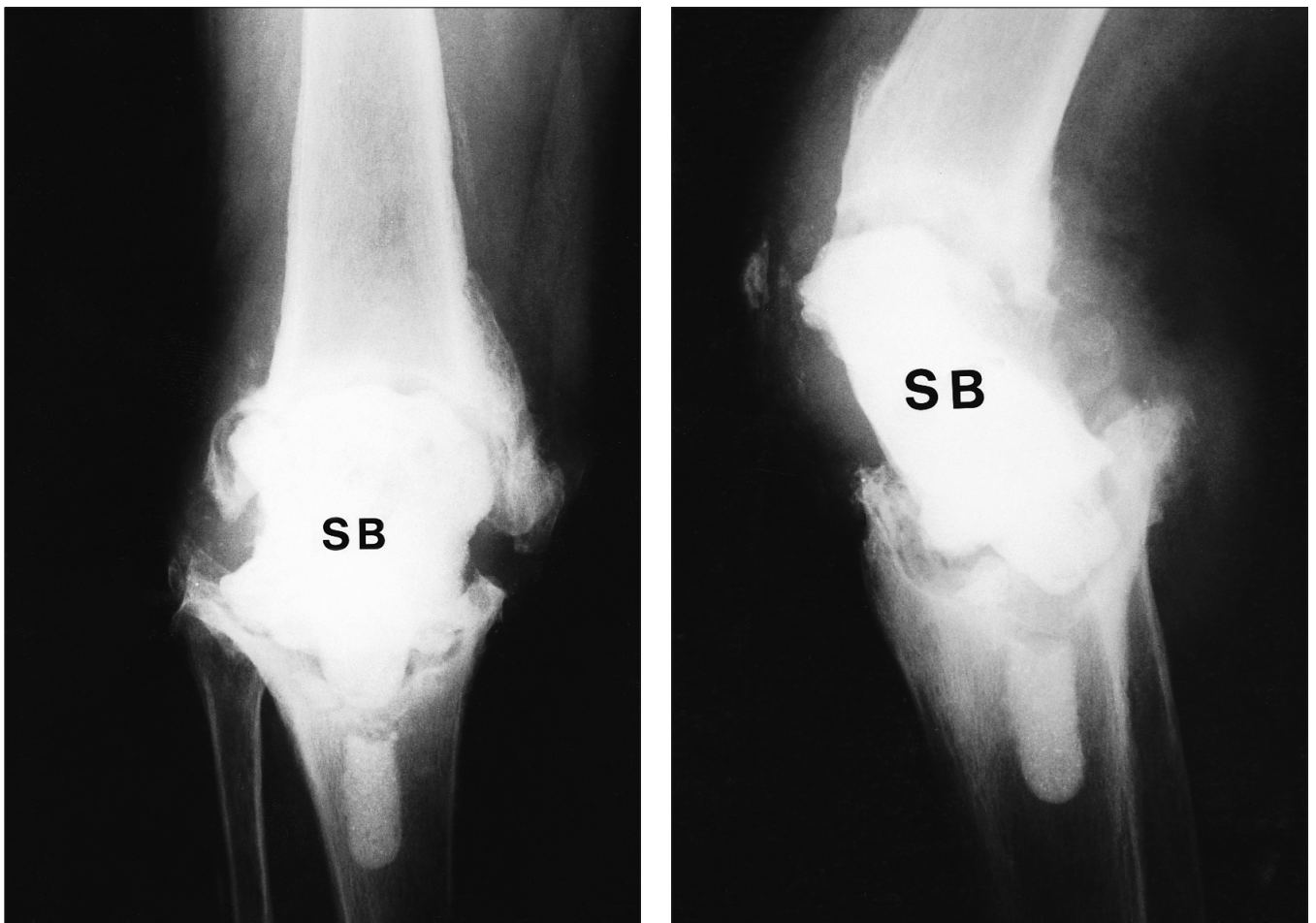


FIG. 1. A previously infected knee prosthesis (left) was removed and an antibiotic cement spacer inserted (right).

quiring analgesics but not affecting function in 9% and moderate to severe pain in 17%. Two of these patients had reflex sympathetic dystrophy of the knee. The range of movement was greater than 100° in 44% of cases, greater than 90° in 84% and greater than 75° in 92%. The patella or patellar tendon tracked in the trochlea in 42 patients and was subluxed in 3.

Complications

Postoperative complications included infection in 6 patients (13%). In 2 of them the infection occurred many years postoperatively, and they are currently being treated with antibiotic suppression. The other 4 patients had infection subsequent to ad-

ditional surgery that was required after the index operation. Two patients required repeat fusion and 2 required revision, 1 of which was a Girdlestone procedure. A quadriceps lag was present in 7 (16%) patients and was generally less than 10°; however, 2 patients had complete loss of extension power. Extensor mechanism problems occurred in 7 (16%). These included a patellar tendon avulsion in 1, patellar avascular necrosis requiring patellectomy in 1, patellectomy for reflex sympathetic dystrophy in 1, patellar tendon avascular necrosis with attempted allograft in 1, quadriceps tendon rupture in 2 and patellar dislocation requiring repair in 1. Three patients (7%) had aseptic loosening. A press-fit tibial prosthesis was used for

a longitudinal fracture in 1 of the patients; when the fracture healed, the stem was simply cemented in place 1 year later. One patient who had a shattered femur had an additional 2 unsuccessful attempts at reconstruction. She required a Girdlestone procedure. Another patient had a fall and broke the lateral femoral condyle. His implant subsequently loosened. Although culture specimens taken at the time of revision were negative, infection was suspected and became obvious subsequently. All these patients had type III lucency prior to revision. A stress fracture of the ipsilateral femoral neck developed several months postoperatively in 2 patients. One patient required a total hip replacement³ and in the other patient the fracture healed

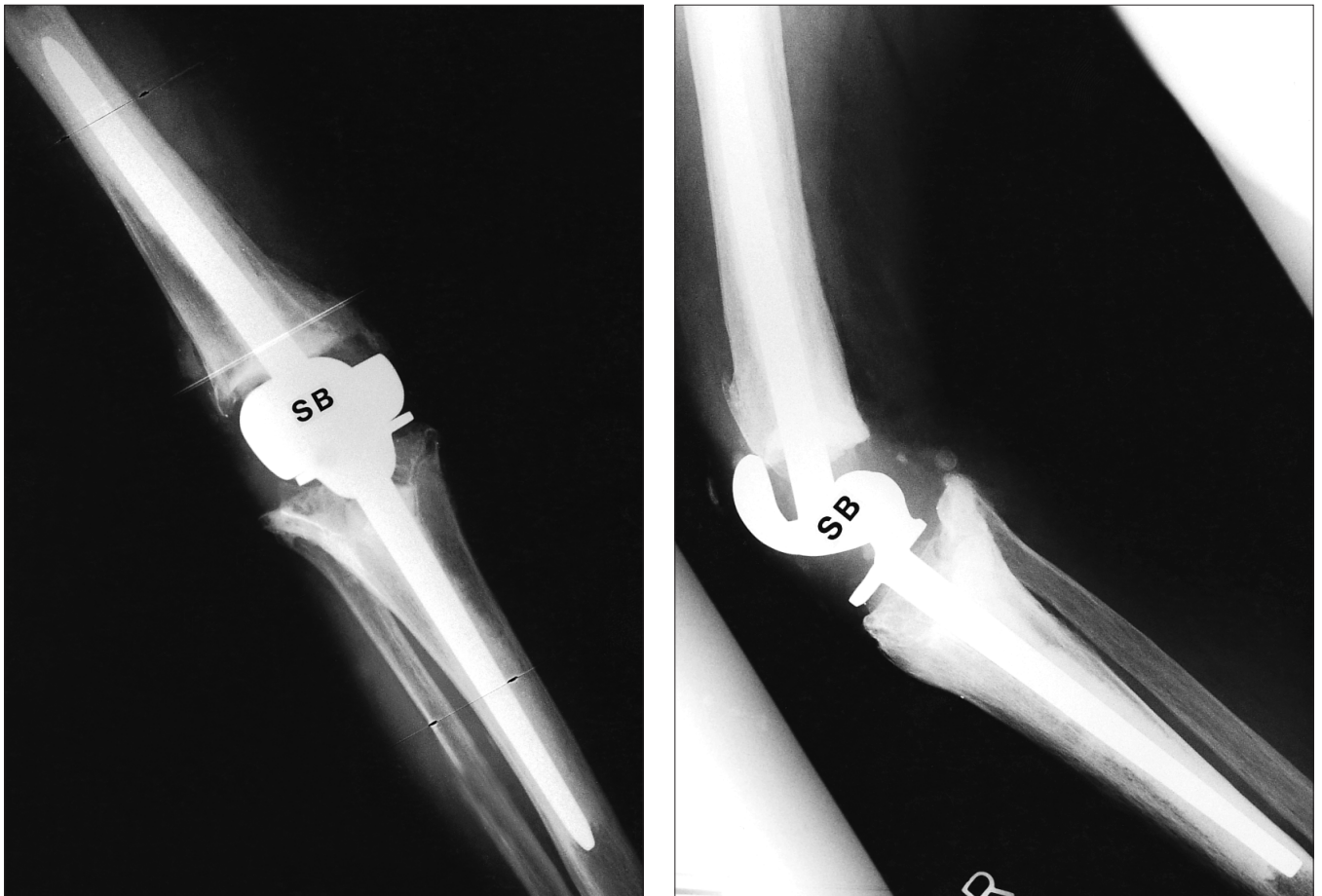


FIG. 2. A few weeks later a Guepar II prosthesis was cemented in place. There was considerable bone loss.

with conservative management (Figs. 3 and 4).

DISCUSSION

Initially, loosening was thought to have been the main problem with a fixed-axis prosthesis, but a striking fact emerging from this study is that loosening is really not a problem. In retrospect, the loosening reported in earlier series was almost certainly due to stems that were too short and cementing techniques that were inadequate. In the initial report on this group of patients, the senior author was concerned about the rapid development of lucency close to the knee where a previous stem component had been used. However, the lucency does not seem to have progressed. One factor that may be important is that the replacements were done as salvage procedures in patients who were generally elderly with multiple comorbidity and hence made relatively low demands on their knees. Also remarkable is that whereas the occurrence

rate of lucency in press-fit stems is much higher than in cemented stems, none have required revision for symptomatic loosening except 2 predictable cases. The Guepar II prosthesis is not designed as a press-fit stem, a fact that makes this finding all the more surprising and indicates the potential for a noncemented hinge-type prosthesis.

In the initial series reported in 1989, the clinical results were 66.6% good or excellent, 29.7% fair, and 7.7% poor. The current rating is 38% good or excellent, 20% fair and 42% poor. One reason for this change is that many patients in the initial series are now very elderly with consequent reduction in activity level. Furthermore, in the last 5 years, as the degree of constraint offered by constrained condylar type knees has increased, the indications for a fixed-axis knee have decreased. Consequently, patients requiring a fixed-axis prosthesis have had much more severe disease with a predictably poorer outcome.

In reviewing the world's literature

on the subject of hinges, we felt that the early reports would simply reflect poor design and poor cementation. Hence, only reports published in the last 10 years were considered. Cases of tumour were also excluded as these obviously present a somewhat different situation.

Blauth and Hassenpflug,⁴ using the Blauth hinge in 497 knees with a mean follow-up of 45 months, found an aseptic loosening rate of 1.2%, a deep infection rate of 3% and extensor mechanism problems in 10%. Eighty-eight percent of the patients had knee flexion greater than 90°. No indications for operation were given. Hoikka and associates,⁵ using the Guepar I prosthesis, reported on 55 cases, with a follow-up of 5 years. The rate of loosening was 14.5%. In 3 cases, arthrodesis was carried out. Patellar subluxation and dislocation were noted in 45.5% of cases. Indications were not given, but it was recommended that a hinge only be used in aged patients with extremely damaged and unstable knees. Karpinski and Grimer,⁶ using the Stanmore hinge,



FIG. 3. A Guepar II prosthesis was used for revision in this extremely elderly patient with a very unstable knee.

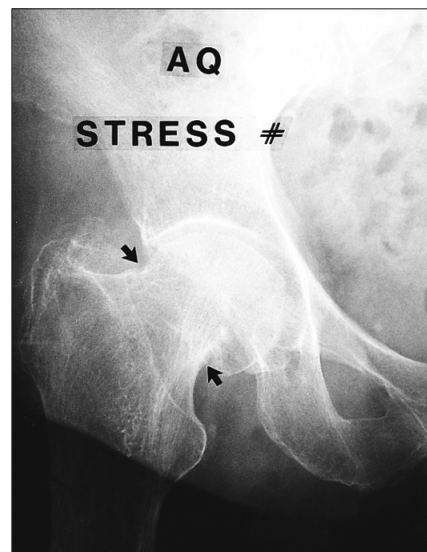


FIG. 4. A few months later, the woman whose knee is shown in Fig. 3 complained of ipsilateral hip pain. X-ray films showed a stress fracture of the femoral neck (arrows). This healed with conservative treatment.

followed up 52 patients after knee revision. Infection was noted in 4% of patients, and 2 patients had aseptic loosening. Poor results were obtained in 29% of patients.

Shindell and colleagues,⁷ using the Noiles knee, reviewed 18 patients with knee replacement. In 56%, the operation failed within 32 months. No indications were given. Egsted, Olsen and Krogh⁸ reported on the use of the St. George hinge prosthesis in 38 knees. There was a loosening rate of 3.5% and an infection rate of 3.8%. Indications were not given.

The St. George hinge, the original Guepar prosthesis, and the original Noiles knees are now obsolete. Except with these components, loosening has not been a major problem. Extensor mechanism problems do exist and may in part be due to the fixed-axis nature of these prostheses. When most of these prostheses were used, however, the need to externally rotate the femoral component slightly was probably unrecognized. A rotating platform tibial component may help with patellar mechanics. The majority of extensor mechanism problems we experienced, however, related more to multiple surgeries with consequent problems with blood supply to the extensor mechanism than to the prosthesis.

Infection remains a concern, and the problems experienced in removing a cemented long stem may be formidable and make re-revision exceedingly difficult, although the advent of the modular hinge prosthesis may render this possible.

With the availability of posteriorly stabilized knees, constrained condylar knees and other knees with modular stems, some of the original indications used in this series no longer apply. The main indication that we still feel exists is anteroposterior instability, especially if there is a very large flexion

gap in comparison to the extension gap, complete absence of the medial collateral ligament and lateral rotational instability due to complete absence of any lateral stabilizing structures. Complete absence of any functional extensor mechanism also requires a hinge prosthesis capable of slight hyperextension to allow a swing-through gait.

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This list is an acknowledgement of books and other media received. It does not preclude review at a later date.

Cette liste énumère les livres et autres documents reçus. Elle n'en exclut pas la critique à une date ultérieure.

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