

Minimum 10-year follow-up results of ALPINA cementless hydroxyapatite-coated anatomic unicompartmental knee arthroplasty

F. Lecuire · J. B. Berard · S. Martres

Received: 18 December 2012 / Accepted: 8 February 2013 / Published online: 2 March 2013
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Abstract One hundred and one unicompartmental knee arthroplasties (UKA) were done between 1996 and 2000 with ALPINA[®] UNI, a cementless hydroxyapatite-coated anatomic prosthesis. Sixty-five knees were available for the long-term follow-up at a mean of 11 years. The mean IKS improved from 119.3 ± 16.8 points preoperatively to 171.4 ± 25.3 at the latest follow-up ($p < 0.0001$). Eighty-nine percentage of the knees were rated good and excellent. The mean knee flexion has significantly improved from $120^\circ 5$ preoperatively to $127^\circ 3$ at the latest follow-up ($p < 0.01$). Eleven revision procedures were done: 1 for early knee degeneration on rheumatoid arthritis, 1 for degeneration of osteoarthritis in the opposite compartment of the knee, 1 for unexplained pain and 1 for late ACL rupture, all these 4 cases were replaced by total knee arthroplasties; 3 revisions by another UKA were done due to polyethylene insert fracture; and 4 partial revision were done for bearing exchange due to severe polyethylene wear. When *revision for any reason* was defined as the end point, the 13-year Kaplan–Meier survival rate was 88 % (95 % CI 81–95 %) and when *revision due to implant mechanical failure* (excluding degeneration of osteoarthritis in the opposite compartment of the knee and bearing exchange only) was defined as the end point, the 13-year survival rate was 94 % (95 % CI 89.1–99.1 %).

Keywords Cementless hydroxyapatite (HA) coated · Unicompartmental knee · Long term follow-up

Introduction

Encouraging results pertaining to different prostheses such as the Oxford congruent prosthesis [1–3], Marmor low contact unicompartmental knee [4, 5] and the cemented or cementless Miller Galante unicompartmental knee [6–9], confirmed the renewed interest in unicompartmental knee arthroplasty.

The ALPINA UNI (Biomet France), introduced in 1994, is one of the recent unicompartmental knee prostheses. To meet anatomic requirements and particularly the differences between medial and lateral condyles and to match with different patient morphotypes, the ALPINA UNI femoral component comes in 4 ranges (left and right medial components, left and right lateral components). This prosthesis is available in cemented and cementless hydroxyapatite (HA)-coated versions, with a specific ancillary, which allows different degree cuts in frontal and sagittal plans. We have reported encouraging results at 7-year follow-up of the ALPINA knee [10].

The purpose of this single-centre retrospective study was to report greater than 10-year clinical outcome and survival of the cementless HA-coated ALPINA unicompartmental knee prosthesis.

Materials and methods

Patients

From 1996 to 2000, a single surgeon performed 101 consecutive arthroplasties using the cementless HA-coated ALPINA UNI anatomic unicompartmental knee (Biomet France, Valence) (Fig. 1). The femoral component was cobalt–chromium alloy. The tibial tray was titanium alloy.

F. Lecuire (✉) · J. B. Berard · S. Martres
Hôpital Renée Sabran, Boulevard E. Herriot,
83406 Hyères Cedex, France
e-mail: francois.lecuire@chu-lyon.fr



Fig. 1 The ALPINA[®] UNI anatomic unicompartmental knee. For the femoral component, the internal surface is grooved and roughened for the cemented fixation and HA-coated for the cementless fixation. Two pegs at 30° angle increase the fixation and the stability of the femoral component. The tibial tray fixation and stability are ensured by 3 systems: a medial keel, a peg and an optional screw. Surfaces are grooved and roughened for the cemented fixation and HA-coated for the cementless fixation

The insert was UHMW Polyethylene HD 1000 (BIOMET Inc, Warsaw, IN). The average thickness of the PE insert was 9 mm (range 8–12 mm).

Among the 65 ALPINA UNI knee arthroplasties available for the long-term evaluation, 61 (94 %) were medial UKA requiring internal parapatellar surgical approach and 4 (6 %) were lateral arthroplasties.

Patients were predominantly females (72 %). The mean age of 65 studied patients was 71.8 ± 4.9 years (range 50–80 years), and their mean body mass index (BMI) was 28 ± 3.8 kg/m² (range 20–38.4 kg/m²). Fifty-four percentage of these patients were overweighted ($25 < \text{BMI} < 30$ kg/m²) and 26 % were obese.

The indication was mainly unicompartmental osteoarthritis (93 %) (Table 1).

The ancillary allowed the choice of different degree cut in frontal and sagittal plans to adapt the prosthesis to

Table 1 Baseline characteristics of study patients

	Knees (patients)
Number	65 (64)
Gender (M/F)	28/72 %
Mean age at surgery (years)	71.8 ± 4.9
BMI (kg/m ²)	28 ± 3.8
BMI class (%)	
≤ 25	20
25–29	54
≥ 30	26
Operated side (%)	
Right	49
Left	51
Knee compartment (%)	
Lateral	6
Medial	94
Diagnosis (%)	
Osteoarthritis	93
Osteonecrosis	7
Knee Society score (KSS)	119.3 ± 16.8
Femorotibial axis (°)	
Medial unicompartmental knee	172.8 ± 3.7
Lateral unicompartmental knee	188.2 ± 2.0

patients' morphologies. The tibial procedure respected the posterior slope and tibial varus or valgus angle (Fig. 2).

Clinical and radiographic assessments

Postoperative clinical and radiographic assessments were done at 3, 12, 24 months, 5 years and 10 years or later.

Patients were evaluated clinically and functionally with the International Knee Society clinical rating system [11].

Preoperative, immediate postoperative and follow-up weight-bearing anteroposterior, lateral and skyline view radiographs were taken. Serial radiographs were reviewed for evidence of femoral or tibial component loosening. Clinical and radiographic femorotibial angles (HKA) were calculated on the whole leg radiographs (pangonograms). Polyethylene (PE) wear was evaluated directly on the weight-bearing AP view X-ray. PE wear was defined as a decrease in spacing between the femoral component and the tibial baseplate compared to the initial radiograph.

Statistical analysis

Data analysis was conducted with SPSS 13.0 package (SPSS Inc, Chicago, IL).

Survival rates and 95 % confidence intervals were calculated using the Kaplan–Meier method [12], with 2 different endpoints: implant revision for any reason and



Fig. 2 ALPINA UNI knee in place after 13 years. Weight-bearing anteroposterior radiographs performed 13 years after surgery showing minimal cuts, good implants osteointegration and no evidence of polyethylene wear

implant revision due to mechanical failure (excluding disease degeneration in opposite compartment of the knee or other unrelated reasons).

Preoperative and postoperative Knee Society scores were compared with the Student *t* test for paired data.

Between-group comparisons were conducted by using the χ^2 test for categorical/ordinal variables and by a univariate analysis of variance (ANOVA) for continuous variables.

Results are given as percentage or as mean \pm SD if not otherwise specified.

Results

Of the 99 patients (101 ALPINA UNI knees), 22 (22 %) had died at a mean 6.7 years after surgery, 3 (3 %) were lost to follow-up, 11 (11 %) underwent revision surgery leaving a final study group of 64 patients (65 knees).

To ascertain implant survival, patients who were unable to attend a follow-up visit were contacted by telephone and mail, and in the case of deceased patients, all available records were reviewed, General Practitioners and relatives

were contacted. None of the deceased patients or lost to follow-up patients were known to have a reoperation or revision at latest follow-up. One cardiovascular accident not related to the surgical procedure and seven venous thromboses were reported. Locally, one tibia fracture occurred during intervention. No infection was reported in these series.

Clinical and radiographic results

At an average follow-up of 11 years (range 10–13 years), the mean Knee Society combined knee and function scores significantly improved from 119.3 ± 16.8 points preoperatively to 171.4 ± 25.3 ($p < 0.0001$) with 78 % of the knees rated excellent (163–200 points), 11 % rated good (135–162 points) and 11 % rated bad.

The mean knee flexion has significantly improved from $120^\circ 5$ preoperatively to $127^\circ 3$ at the latest follow-up ($p < 0.001$).

The mean posterior tibial slope achieved postoperatively was 6.6° versus 6.8° planned. The mean postoperative tibial inclination angle in sagittal plan was 1.7° versus 3° planned, and the mean femoral inclination angle in frontal plan was 6° versus 6.5° planned (Table 2).

The average femorotibial alignment was $172.8 \pm 4.3^\circ$ ($172.8 \pm 3.7^\circ$ preoperatively) for the medial unicompartmental knees (94 % of the knees) and $184 \pm 3.5^\circ$ ($188.2 \pm 2.0^\circ$ preoperatively) for the lateral unicompartmental knees (6 % of the knees).

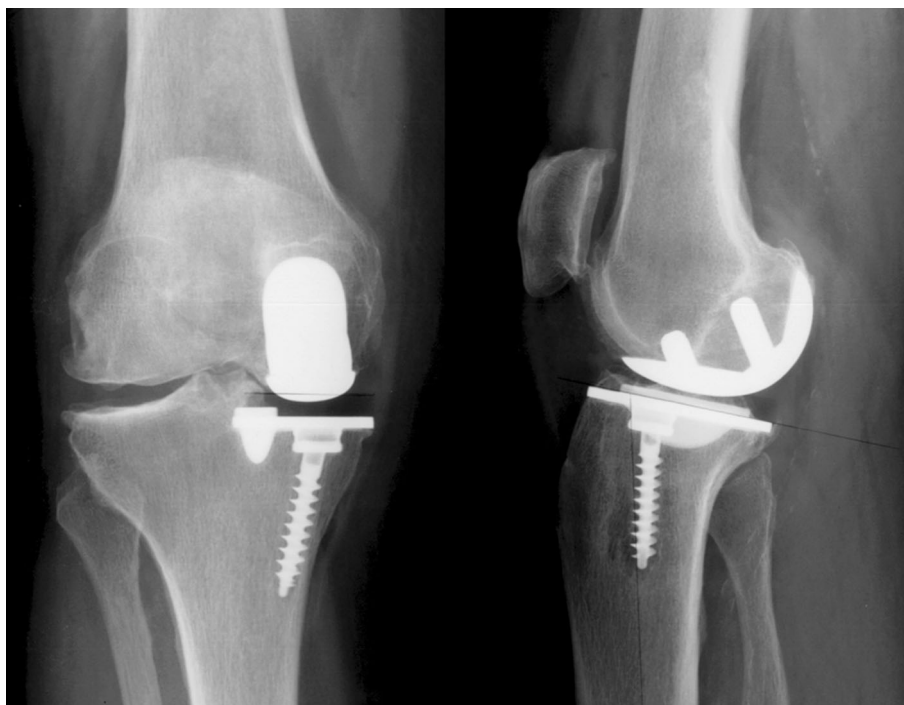
Six patients had partial radiolucent line around the tibial component without any impact on implant stability. All these radiolucent lines were stable over time. No radiolucent line was observed on femoral side. Ten patients had lytic zones around the additional baseplate screw fixation used in this series (Fig. 3). None of those lytic zones impaired implant stability.

Four patients had arthritic degradation of the opposite compartment of the operated knee and 12 patients had arthritic degradation of the femoro-patellar compartment, 6 of those are mild and 6 serious. None of the 16 had discomfort. One of those patients had a consultation for femoro-patellar pain but did not want revision surgery proposed.

Table 2 Planned angles versus angles measured postoperatively

	Mean angle planned	Mean angle achieved	<i>p</i>
Posterior tibial slope	6.8°	6.6°	0.13
Tibial inclination angle in sagittal plan	3°	1.7°	0.001
Femoral epiphyseal valgus angle	6°	6.5°	0.001

Fig. 3 Implant with zones of lyses around the additional baseplate screw fixation



At the latest follow-up, it was noted a less than 1-mm PE wear in 22 % of the knees, a PE wear between 1 and 2 mm in 21 % of the knees and a more than 2-mm wear in 6 % of the knees (Fig. 3). 51 % of the knees did not show any PE wear.

Revisions

A total of 11 revision surgeries were reported in these series: 1 knee was revised at 1 year post-surgery for early degeneration of an inflammatory rheumatoid knee, 1 knee revised 7 years post-surgery due to the degeneration of osteoarthritis in the opposite compartment of the knee; 1 unexplained pain and 1 ACL rupture resulted in implant revision at, respectively, 8 and 9 years post-surgery. Those 4 implants were revised using total knee arthroplasty. Three other knees had a revision by another unicompartmental knee because of polyethylene insert fracture at, respectively, 4, 5 and 5 years after surgery (Fig. 4). Four additional revision surgeries were performed between 2 and 6 years post-surgery for polyethylene bearing exchange only further to wear (Fig. 5).

When *revision for any reason* was defined as the end point, the 13-year Kaplan–Meier survival rate was 88 % (95 % CI 81–95 %) (Fig. 6). When *revision due to implant mechanical failure* (excluding degeneration of osteoarthritis in the opposite compartment of the knee and bearing exchange only) was defined as the end point, the 13-year survival rate was 94 % (95 % CI 89.1–99.1 %) (Fig. 7).

Discussion

We report the results of a retrospective, consecutive, single-centre series of ALPINA cementless hydroxyapatite-coated unicompartmental knee at minimum 10-year follow-up (10–13 years).

The 13-year survivorship of this implant (88 % regardless of the reason for revision, 94 % when revision is due to implant mechanical failure) is comparable to the published results in the literature (Table 3) and slightly lower than the best single-centric series.

In the series reporting more than 10-year follow-up results, survival rates are satisfactory. With the Oxford mobile-bearing prosthesis, Murray reports 98 % survival [1]. But the original concept of this implant, probably more demanding in its implantation, gives more reliable results on the medial compartment as reported by different authors (95 % survival by Svard [3], 93 % by Price at 10 years [2]) than on the lateral compartment (only 67 % survival for Gunther [13]).

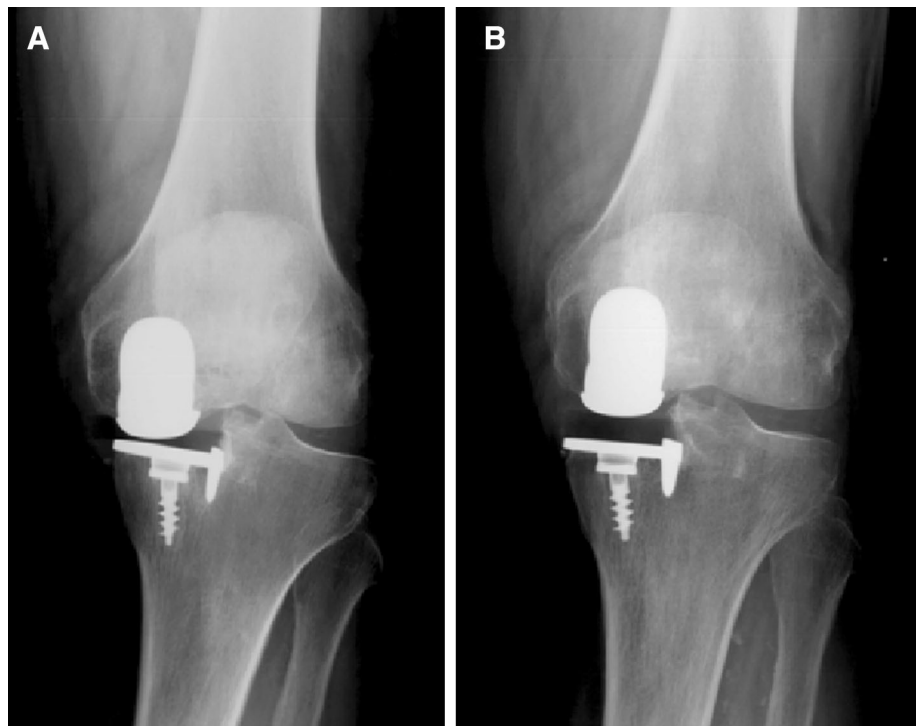
One should note that the Oxford implant seems the only one where significant differences in survival were reported between the medial compartment and lateral compartment. Ashraf [14] reported, for example 83 % survival at 10 years with the St Georges prosthesis in the lateral compartment, Pennington [13] 92 % survival with the Miller Galante.

Survival rates of different implants are generally between 80 and 98 % at 10 years, except for some implants where failures are related to design error or poor quality of polyethylene (58 % survival reported by Skyrme with PCA) [16].

Fig. 4 Polyethylene fracture at 5-year follow-up



Fig. 5 Wear of the unicompartmental knee arthroplasty at 6 years post-surgery (a). Simple PE replacement (b)



The results are better in more recent series than in the older series sometimes with the same implant (70 % for Marmor [4], 93 % for Cartier with Marmor prosthesis) [5].

These better results may be due to the improvement of technology, ancillaries, implants, and especially a better selection of indications.

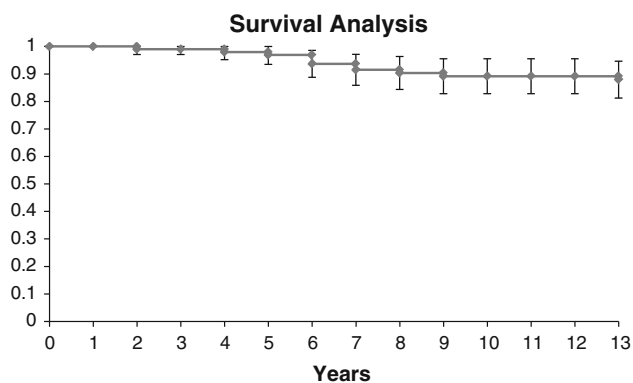


Fig. 6 13-year Kaplan–Meier survival rate was 88 % (95 % CI 81–95 %) with revision for any reason as the end point

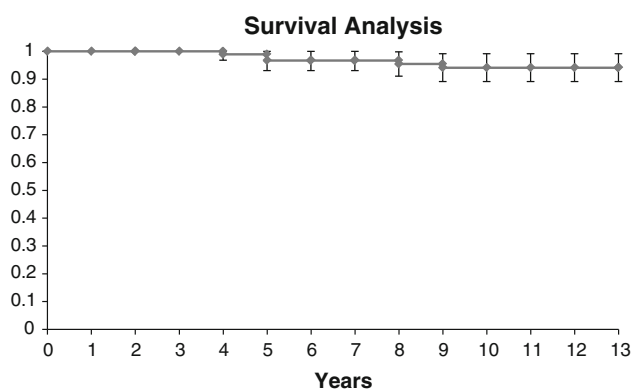


Fig. 7 13-year Kaplan–Meier survival rate was 94 % (95 % CI 89.1–99.1 %) with revision for implant mechanical failure as the end point (excluding degeneration of arthritis in the opposite compartment of the knee and bearing exchange only)

With the cemented Miller Galante prosthesis with a fixed polyethylene in tibial metal back tray, several published series reported excellent survival rates at 10-year follow-up: 86 % by Naudie [6], 92 % by Pennington [7], 94 % by Argenson [9], 98 % by Berger [8].

Multiple series or registries publications showing the results of implants with different designs, implanted by surgeons whose experience is variable are very interesting. They therefore limit the impact of centre or the effect of the implant.

The survivorship reported were 67 % for Hernigou and Deschamps [17] in old series, 70–98 % for Desmukh [18], 79 % for Koskinen (Finnish register) [19], 88.6 % for Gioe [20], 90 % for Hang (Australian Registry) [21], 90 % for Lewold (Swedish registry) [22].

Our series is therefore rather in a low range, and we will analyse the causes.

In any case, all series published over 10 years of follow-up show survival rates clearly worse than total knee arthroplasties (TKA) at the same follow-up.

This was emphasized by several authors and confirmed by registries reports: 10 % revision rate for UKA compared to 3–10 % revision rate for TKA at 10 years in the Swedish registry (Lewold [22]), 80 % survival at 10 years for UKA against 91–94 % survival for TKA in the Finnish registry (Koskinen [19]).

In terms of morbidity, complications reported are rare, especially when compared to total joint replacement.

In our series, we found 7 venous thromboses, without any pulmonary embolism, but without systematic control by Doppler examination.

At our most recent surgery, we find after routine Doppler monitoring, 13 % of distal thrombosis for UKA, against 25 % for TKA, with significant number of high thrombosis (popliteal) for the TKA group.

The risk of infection is also very low for UKA. No infection was found in our series. Many authors do not even address the subject. Argenson [9] and Naudie [6] did not report any. Price [2] describes two infections in his series requiring revision surgery, while Hernigou and Deschamps [17] reported only 4 infections out of the 70 reoperations in their multiple series of 482 medial compartment UKA.

In the Australian registry assessed by Hang [21], infection accounts for only 5 % of their huge number of 1948 revised UKA between 1999 and 2008, compared to 23 % infection rate in revised TKA group.

We deplore one intra-operative vertical fracture of the internal tibial plate. This fracture was simply repaired with a screw leading to a 6-week delay in weight bearing without any further complications. In their series, Berger et al. [3] also reported 3 tibial fractures.

The reasons for prosthetic revisions in our series are slightly different from the literature (Table 4).

If we exclude a misdiagnosis and bad indication on inflammatory arthritis leading to very quick degeneration of the knee, one patient was reoperated 9 years post-surgery due to a traumatic rupture of the anterior cruciate ligament leading to highly progressive posterior wear with an unstable knee. We have not found this reason for revision in any other series.

One patient was reoperated for degeneration of the lateral compartment of the knee 7 years postoperatively and received a TKA. This cause of failure is reported in published series: in registries (17 % revisions by Hang [21], 25 % revisions by Lewold [22], 50 % by Gioe [20]), and in single-centre series (3 early cases by Argenson [9], 18 % revisions by Berger [8], 7 out of 23 revisions by Price [2]).

However, it should be noted that if one of our patients had to be reoperated for progression of the arthritis, we found frequent radiological degeneration in the knee compartment without prosthesis. Either in the femorotibial compartment (4 cases) or especially in the patellofemoral

Table 3 Survivorship of unicompartmental knee arthroplasty—a literature review

Authors	Number of cases	Type of unicompartmental knee	10-year survivorship (%)
Svard [3]	124 (medial)	Oxford	95
Murray [1]	144	Oxford	98
Price [2]	114 (medial)	Oxford	93
Gunther [13]	53 (lateral)	Oxford	67
Ashraf [14]	88 (lateral)	St Georges	83
Marmor [4]	228	Marmor	70
Cartier [5]	60	Marmor	93
Naudie [6]	113	Miller Galante	86
Pennington [7]	66 (less 60 years)	Miller Galante	92
Berger [8]	49	Miller Galante	98
Argenson [9]	160	Miller Galante	94
Skyrme [16]	26	PCA	58
Epinette [23]	45	Unix uncemented HA	96
Lecuire [10]	101	Alpina uncemented HA	88
Hernigou Deschamps [17]	Multiple series	Multiple	67
Deshmukh [18]	Meta analyse	Multiple	70–98
Koskinen [19]	Registry	Multiple	79
Gioe [20]	Registry	Multiple	88.6
Hang [21]	Registry	Multiple	90
Lewold [22]	Registry	Multiple	90

Table 4 Details of the 11 revision surgeries

Diagnoses	Reason for revision	Time to revision (years)	Procedure	Outcome
1. Primary arthritis	Polyethylene wear	6	Polyethylene change	Good at 1 year Lost to FU
2. Primary arthritis	Polyethylene wear	2	Polyethylene change	Good at 4 years Died
3. Primary arthritis	Polyethylene wear	6	Polyethylene change	Good
4. Primary arthritis	Polyethylene wear	5	Polyethylene change	Good
5. Primary arthritis	Polyethylene fracture	5	UKA to UKA	Good
6. Primary arthritis	Polyethylene fracture	5	UKA to UKA	Good
7. Primary arthritis	Polyethylene fracture	4	UKA to UKA	Good at 1 year Died
8. Primary arthritis	ACL rupture	9	UKA to TKA	Good
9. Primary arthritis	Unexplained pain	8	UKA to TKA	Fair
10. Primary arthritis	Lateral arthritis	7	UKA to TKA	Good
11. Rheumatoid arthritis	Knee degradation	1	UKA to TKA	Good

compartment (12 cases: 6 moderate arthritis and 6 severe arthritis).

This understandable degeneration beyond 10 years of implantation was reported by several authors. Hernigou and Deschamps [17] found 18 % remodelling, 8 % of osteoarthritis in the patellofemoral compartment, 19 % remodelling, 9 % of true osteoarthritis in the femorotibial compartment. In the series of Pennington involving

subjects less than 60 years of age [7], 9 operated patients out of 46 have a net osteoarthritis in the other compartment. Naudie [6] noted 60 % increase in femoro-patellar osteoarthritis in his series. In his series of 439 prostheses, Price [2] found 19 % of osteoarthritis of the other compartment and 11 % of femoro-patellar osteoarthritis.

One of our patients was reoperated for unexplained pain 8 years post-surgery. His result after revision with a TKA

remains poor. These revisions due to pain are found in the series reported by Hang [21], Gioe (3 % of revisions) [20], Price (1 case) [2].

According to Price et al. [1] and Hernigou et al. [11], axial hypercorrection may increase the risk of degeneration in the opposite compartment. To reduce this risk, Pennington et al. [8] and Argenson et al. [4] believe that patients' selection criteria for unicompartmental knee procedure must include careful preoperative radiographic analyses of the opposite compartment and the femoro-patellar joint.

The main cause of revision in this series was polyethylene wear (4 cases) or polyethylene fracture (3 cases), leading to relatively early revision in our cases (2–6 years for wear, 4–5 years for fracture).

The origin of this too early problem is probably multifactor: Polyethylene quality certainly insufficient at the beginning of the commercialization of this implant. Since 2001, the manufacturer has adopted the Arcom process for the manufacturing of polyethylene and we no longer experience fracture on a very large number of implantations, and the problem of polyethylene wear seems to be solved at least at the medium term.

The problem was probably exacerbated by the technical choices for this implant: metal back reducing polyethylene thickness, certainly insufficient for thin trays. The manufacturer has stopped marketing 8 mm thicknesses (5.5 mm polyethylene only).

The absence of lateral retention of the polyethylene by the titanium base plate and the presence of a fixation peg at 1/3 anterior and 2/3 posterior junction lead surely to the creep, especially in small thicknesses. We must note that a lateral retention of the insert by metal edge may increase early metal–metal contact risk in case of wear. These 7 patients were reoperated simply, without switching to a TKA: a simple change of the worn polyethylene insert without touching the metal parts particularly easy and simple intervention for modular implants, simple UKA change for fracture cases because of metal–metal contact, intervention which did not pose any technical problem and gave good results.

This option of partial or total replacement of UKA without switching to TKA is clearly discouraged in Australian registry (Hang [21]) and Swedish registry (Lewold [22]) where three times more iterative revisions were reported in case UKA was not replaced by TKA.

Revision for polyethylene wear was reported by several authors.

While Argenson [19] and Pennington [7] have reported 2 partial replacement of UKA, Naudie [6] has performed 3 complete replacements by 3 TKA. For the 6 dislocations and 1 polyethylene insert fracture of the Oxford knee in his series, Price [2] adopted an eclectic attitude with 4 changes of inserts and 3 revisions with TKA.

The polyethylene fracture appears to be specific to non-retained inserts and only 1 case was reported by Price in his Oxford series [2].

On the other hand, polyethylene insert dislocation of UKA with a tibial metal back is a specific complication of the Oxford mobile bearing (6 cases reported by Price [2], 4 cases by Svard [3]).

For the patients who had no revision surgery, polyethylene wear was easily measured on weight-bearing X-ray radiographs, because the prosthetic interline was carefully cleared during the X-ray procedure.

At the latest follow-up, 51 % of patients have no visible polyethylene wear, 22 % had 1-mm wear, 21 % had wear between 1 and 2 mm, 6 % had more than 2-mm wear.

In a large series reported during the Symposium of Société française de chirurgie orthopédique [11], the mean polyethylene wear was 1.8 mm with a maximum value of 3 mm measured beyond 10 years. With the Oxford congruent knee, Price et al. [1] reported no revision for polyethylene wear but observed 6 dislocations and one fracture of polyethylene.

In our series, it should be noted that we observed no loosening at minimum 10–13-year follow-up now.

Several authors did not report loosening in series of Miller Galante cemented UKA: Argenson [9], Berger [8] and Pennington (on his 29 lateral UKA) [15]. Only Naudie [6] and Pennington [7] (with 1 out of 46) report loosening as reason for revision which is rare with this implant.

Presumably, there is an implant-related effect on the risk of loosening since Price [2] reported 6 loosening out of 23 revisions in his series of 439 Oxford UKA, and Ashraf [14], 6 loosening out of 88 lateral Saint Georges UKA.

In all the multicenter series with various implants, loosening represents a significant amount of the causes of revision: 67 loosening out of 483 medial UKA in the series by Hernigou and Deschamps [17], 26 % of the 39 revisions in the series of 516 UKA published by Gioe [20].

Finally, loosening represents 45 % of revisions in Swedish registry (Lewold) [22] and 50 % of revisions in the Australian registry (Hang) [21].

The results of our homogeneous series of hydroxyapatite-coated cementless UKA confirm the excellent reliability of a cementless less-constrained implant already shown by the works of JA Epinette [23].

Osteointegration of the cementless implants was excellent with no radiolucent line on femoral component and six non-progressive radiolucent lines on the tibial component with no impact on implant stability.

Tibial component radiolucent lines were frequently reported particularly in congruent unicompartmental knees such as the OXFORD knee by Tibrewal and Price [1, 24] (57 % of complete tibial lucent lines), but also in less contact surface knees such as the Miller Galante (15 %

reported by Argenson et al. [4] and Naudie et al. [6]). Pennington [15] reported 3 cases out of 29 and especially Berger [8] reported 47 % incomplete and 6 % complete tibial lucent lines with this implant.

Although these lucent lines are worrying, they do not seem to compromise mid- to long-term clinical results.

ALPINA unicompartmental knee prosthesis was designed to reconstruct the knee joint close to the original anatomy by restoring knee kinematics and ligament balance. The reliability of the ancillaries was satisfactory for both frontal and sagittal plan cuts. The restoration of the tibial slope and the frontal inclination of both the tibial and the femoral components may contribute to the good functional results, the good flexion (127° at the latest follow-up) and the implants' longer survival as well. Efforts to match the joint morphotype and the obliquity of the interline spacing were recommended by Hernigou and Deschamps [11].

From the beginning, the ALPINA UNI knee design included a modular system with cemented and hydroxyapatite cementless metal base plate. This metal-backed principle is questionable since it contributes to the decrease in polyethylene thickness and therefore to a higher risk of metallosis in case of severe polyethylene wear. However, we believe that the following advantages of the metal-backed principle outweigh risks: better distribution of constraints on bone, modularity leading to an easy revision of the polyethylene only, preservation of bone stock with the cementless version and therefore an easier revision if required. The metal-backed option allows particularly a perfectly reliable cementless implantation of ALPINA UNI knee, which may be an advantage for minimal invasive approach.

It should be noted that in this series, as in all published series, revisions, whatever the cause of failure, have always been held without particular technical problem, whether to replace a UKA by another UKA, or a UKA by a TKA. We therefore confirm the opinion of Jackson [25], Mac Auley [26] and the conclusions of registries' studies (Lewold [22] and Hang [21]).

This easy revision is for many surgeons an argument for choosing this type of arthroplasty when possible.

Conclusion

This long-term study of uncemented Alpina UKA allows some useful conclusions. The procedure is reliable, easier and less invasive than total knee replacements, especially with the minimally invasive surgery instruments in use for 8 years. The morbidity and the risk of infection are extremely low. Functional results are better than total knee replacements, with better pain control, higher flexion and better stability.

Although the 10-year survivorship remains lower than for total knee replacements, the revision surgeries that performed following unicompartmental arthroplasties failure were simple and their conversion to total knee replacement successful [15, 16]. With more restrictive indications based on patient's age, activity level, weight, importance of deformity, a better preoperative control of the opposite compartment, an adequate surgery technique which respects anatomy in frontal and sagittal plans, axial hypo-correction leaving the implants under load, and also a regular surveillance, the survival results may improve.

Upon our experience with the ALPINA UNI, we believe that unicompartmental knee prosthesis is a good alternative to total knee replacement and osteotomy. And in some cases, especially for young and active patients, it can be a transient choice before considering a total knee replacement. Their conversion to total knee arthroplasty is much easier than conversion of a total knee arthroplasty to another total knee arthroplasty.

Conflict of interest None.

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