Results of a French multicentre retrospective experience with four hundred and eighteen failed unicondylar knee arthroplasties

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Abstract

Purpose By means of a multicentre retrospective study based on the failure of 418 aseptic unicondylar knee arthroplasties (UKA) our aims were to present the different types of revision procedure used in failed UKAs, to establish a clear operative strategy for each type of revision and to better define the indications for each type of revision.

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Methods Aseptic loosening was the principal cause of failure ($n=184$, 44 %) of which 99 cases were isolated tibial loosening (23.5 % of the whole series and 54 % of all loosening), 25 were isolated femoral loosening (six and 13.6 %) and 60 were both femoral and tibial loosening (14.3 and 32.6 %). The next most common causes of failure were progression of arthritis ($n=56$, 13.4 %), polyethylene wear ($n=53$, 12.7 %), implant positioning errors ($n=26$), technical difficulties ($n=six$) and implant failure ($n=16$, 3.8 % of cases). Data collection was performed online using OrthoWave™ software (Aria, Bruay Labuissiere, France), which allows collection of all details of the primary and revision surgery to be recorded.

Results A total of 426 revisions were performed; 371 patients underwent revision to a total knee arthroplasty (TKA) (87 %), 33 patients (7.7 %) were revised to an ipsilateral UKA, 11 (2.6 %) patients underwent contralateral UKA (ten) or patellofemoral arthroplasty (one) and 11 patients (2.6 %) underwent revision without any change in implants.

Conclusions Before considering a revision procedure it is important to establish a definite cause of failure in order to select the most appropriate revision strategy. Revision to a TKA is by far the most common strategy for revision of failed UKA but by no means the only available option. Partial revisions either to an alternative ipsilateral UKA or contralateral UKA are viable less invasive techniques, which in carefully selected patients and in experienced hands warrant consideration.

Introduction

Failure of unicondylar knee arthroplasties (UKA) is common. Based on current survival rates at ten years follow-up, survival ranges from 53 to 95 % [1–11]. The term “failure” can be defined in a number of ways. For the purposes of this study we have used the Australian Joint Registry definition [6]. This

definition includes any surgical re-intervention and excludes clinical or radiological failure in which patients are not re-operated on. Such failures are multifactorial and can be due to tibial, femoral or tibiofemoral loosening, progression of arthritis, polyethylene wear, infection, surgical errors and “unexplained” pain. This study is the result of the symposium of the French Hip and Knee Society (Société Française de la Hanche et du Genou, SFHG) held in November 2011 focusing on the causes of failure in UKA [12]. In this retrospective multicentre study involving 25 French orthopaedic teams (Table 1), we have compiled 418 UKA failures (88 % medial and 12 % lateral). Our aims were to present the different types of revision procedure used in failed UKAs (Fig. 1), to establish a clear operative strategy for each type of revision and to better define the indications for each type of revision.

Materials and methods

The series [12]

The series was made up of 418 failures with a total of 426 revisions. Average age at the time of revision was 63.9 years (26–100 years) with 66.3 % women and 33.7 % men. In the series 88 % were medial prostheses and 12 % lateral, 79.6 % had fixed bearing inserts and 20.4 % were mobile bearings whilst 85.5 % of femoral components and 70 % of tibial components were cemented.

Aseptic loosening was the principal cause of failure ($n=184$, 44 %) of which 99 cases were isolated tibial loosening (23.5 % of the whole series and 54 % of all loosening), 25 were isolated femoral loosening (six and 13.6 %) and 60 were both femoral and tibial loosening (14.3 and 32.6 %). The next most common causes of failure were progression of arthritis ($n=56$, 13.4 %), polyethylene wear ($n=53$, 12.7 %), implant positioning errors ($n=26$), technical difficulties ($n=six$) and implant failure ($n=16$, 3.8 % of cases). Further causes included unexplained pain ($n=19$) or painful instability ($n=four$) together accounting for 5.5 % of cases, intra- or post-operative fractures ($n=15$, 3.6 %), infection with or without loosening (five and three) making up 2 % of the total, extension of chondrocalcinosis or osteonecrosis of the opposite side ($n=seven$) and finally other causes not always well identified ($n=24$, 5.7 %).

Methods

The following therapeutic interventions were used: either revision to a total knee arthroplasty (TKA) with or without posterior cruciate preservation, revision to a new UKA, revision by means of a contralateral UKA or patellofemoral prosthesis or revision without change of implants (Fig. 1). Data collection was performed online using OrthoWave™ software (Aria, Bruay Labuissiere, France), which allows

collection of all details of the primary and revision surgery to be recorded.

Results

A total of 426 revisions were performed; 371 patients underwent revision to a TKA (87 %), 33 patients (7.7 %) were revised to an ipsilateral UKA, 11 (2.6 %) patients underwent contralateral UKA (ten) or patellofemoral arthroplasty (one) and 11 patients (2.6 %) underwent revision without any change in implants.

The vast majority of cases in this series were revisions to a TKA. Of these, 62.7 % were with posterior stabilised (PS) designs, 33.2 % were cruciate retaining prostheses (CR) and 4.1 % rotating hinge prostheses. In revision of medial compartment UKAs the previous approach was again used with tibial tuberosity osteotomy performed in 3.75 % of cases in order to improve patellar function either because the patellar tendon adhered to the bone or the patella was low lying. In revision of lateral compartment UKA a medial or lateral approach was used according to surgeon preference. A tibial tuberosity osteotomy was required in 12 % of cases—particularly in revision of lateral

Table 1 French centres participating in the multicentre study

Surgeons	Centres	Number of cases ($n=418$)
Argenson Jean Noël	Marseille	28
Bloch Anthony	Aix-en-Provence	1
Bonnin Michel	Lyon	10
Calas Philippe	Aix-en-Provence	8
Cartier Philippe	Paris	10
Caton Jacques	Lyon	
Cazenave Alain	Berck sur mer	87
Chambat Pierre	Lyon	22
Chatain Frédéric	Grenoble	20
Chol Christophe	Dracy-le-Fort	1
Dejour David	Lyon	8
Deschamps Gérard	Dracy-le-Fort	27
Épinette Jean Alain	Bruay-Labuissière	30
Hernigou Philippe	Paris	10
Lerat Jean Luc	Lyon	3
Mertl Patrice	Amiens	19
Migaud Henri	Lille	7
Molé Daniel	Nancy	32
Moyen Bernard	Lyon	7
Pasquier Gilles	Lille	4
Rouanet Thomas	Lille	1
Rouvillain Jean Louis	Fort-de-France	6
Saragaglia Dominique	Grenoble	57
Tabutin Jacques	Cannes	9
Trojani Christophe	Nice	11

Fig. 1 Main aseptic modes of UKA failures and operative strategies

UKAs using the original lateral approach. Bone loss was evaluated using the Anderson Orthopaedic Research Institute (AORI) classification [13]. Femoral bone loss was rarely significant but was identified in 154 cases (41.5 %), 97 % of which was stage F1 or F2A. In 91 % of cases the new femoral component was implanted without the need for bone grafting or augments. Tibial bone loss was identified in 187 cases (50.4 %). In 93 % of cases, this was either stage T1 or T2A. Tibial bone grafting was required in 112 cases. In 47.3 % of cases we used crushed cancellous bone, in 38.4 % we used fragmented corticocancellous bone coming from the tibial plateau or condylar resection and in 10.7 % of cases a segmental allograft. Metallic augments were used in revising 2 femoral components and 25 tibial components (Fig. 2). A long stemmed implant was used in 18 femoral component revisions and 18 tibial component

Fig. 2 Metallic wedge for revision of medial UKA

revisions. A further four cases required a rotating hinge device in which long stemmed components are standard.

Revision to a contralateral UKA (Figs. 3 and 4) was performed in ten cases at between six months and 19 years post index operation (average time 4.4 years). There were three lateral and seven medial UKAs implanted for contralateral

Fig. 3 Rapid lateral femorotibial narrowing following medial UKA related to chondrolysis. The degradation occurred despite a post-operative HKA angle with 2° of residual varus

Fig. 4 Lateral UKA in addition to medial UKA (case of Fig. 3): excellent result at Day + ten months

degeneration in most cases relating to excessive hypercorrection. Anecdotally one UKA was revised to a patellofemoral implant.

Revision to a new ipsilateral UKA (Figs. 5, 6 and 7) was performed in 33 cases at an average interval of 3.6 years (six months–19 years); 7 % were lateral compartment and 93 % medial compartment. The reason for revision in 46 %

Fig. 6 Changing of the tibial plateau of the Fig. 5 case: excellent result at Day + six years follow-up

of cases was loosening of the tibial component, loosening of the femoral component was the cause of failure in 12 % of cases and loosening of both components in 8 % of cases. In 18 % of cases, component malposition was the reason for revision, 6 % of cases were revised for polyethylene wear and in 10 % of cases no definite cause was identified.

Revision without changing the implants consisted of arthroscopic removal of foreign bodies (cement) in five cases (all at less than six months post initial operation), one arthroscopic lavage at five years follow-up, one arthroscopic medial condyle osteophyte ablation, one fixation of a tibial plateau fracture underneath the implant (30th post-operative day), one removal of metallic debris on the polyethylene insert and two

Fig. 5 Loosening + wear of the polyethylene at five years follow-up of a medial UKA

Fig. 7 Lateral X-ray view of the Fig. 6 case

exchanges of polyethylene inserts on metal backed base plates at ten and 12 years respectively.

Discussion

This study made up of data from 25 French centres represents the largest international series of failed unicompartmental knee arthroplasties outside of the various national registries. This large number is both a strength and weakness of this work. Due to the large number of collaborating institutions it has been impossible to ensure a unified approach to the management of these failures. Whilst bone loss was in most cases assessed pre- and intra-operatively the only objective measures of this were simple radiographs. Furthermore, some teams never revise a failed UKA to a new UKA and other teams frequently use metal augments and long stemmed implants in their revision to a TKA. Despite these limitations this study does provide an exhaustive overview of the various surgical techniques that can be used in the revision of a failed UKA.

There are multiple causes for failure in UKA and the identification of the specific cause is key in determining the optimum operative strategy. In this retrospective multicentre series we have identified “partial” revisions in which the implant was not changed at all (11 cases), was revised to another ipsilateral UKA (33 cases) or a contralateral UKA was implanted (ten cases). This approach is not widespread and there are little or no reports of this in the literature. Revisions in which the implants were not exchanged consisted of seven arthroscopies; five of these were to facilitate the removal of cement situated posterior to the medial tibial implant. Kingler et al. [14] report that arthroscopy in painful knee prostheses can be an excellent way to remove foreign bodies as well as being of diagnostic use in identifying lesions that are not visible on post-operative radiography such as osteochondral or meniscal lesions of the opposite compartment. We have also effectively used arthroscopy in the excision of painful osteophytes (one case in this series).

The revision of a failed UKA to a new ipsilateral UKA is not currently well described. In our series this was performed in 33 revisions (7.7 % of cases). We have found only one other report of this technique in the literature in which the authors suggest using this technique with great care [15]. Patients must be carefully selected and the following rules adhered to: good bone surfaces with no bone loss and limited bone cuts (in general not greater than 12 mm). In addition, it is difficult to recommend the same prosthesis to a patient in whom this has not achieved the desired result at the first attempt, above all when you have to give fair and clear information.

Revision using a contralateral UKA is also of interest. This was performed ten times in our series (2.3 %) of which six were in a single centre. This treatment option evoked by Lustig et al. in 2008 [16] is less invasive than revision to a TKA. Some strict rules must however be followed when choosing

this treatment option: no anomalies in respect of the original implant (malpositioning, loosening, excessive wear, etc.), contralateral pain, intact anterior cruciate ligament, absence of stiffness, long interval since first procedure and older patients (often with significant co-morbidities). In terms of surgical approach, the simplest option is to make an incision on the contralateral side if the original incision was either medial or lateral. If a midline incision was used for the original procedure then this should be reopened and subcutaneous exposure performed as was also suggested by Lustig et al. [16].

Revision to a total knee replacement is by the far the commonest solution reported both in our series and the literature [17–27]. Although widely considered to be easier than revising a TKA and more difficult than a primary knee replacement [25–27], this procedure can present the operating surgeon with several challenges. Reusing the old incision in the case of medial UKAs is relatively straightforward with, where necessary, a tibial tuberosity osteotomy (patella baja or adherent tendon to the bone—3.7 % of cases). In lateral UKA, the lateral incision can be reused although this will often also require a tibial tuberosity osteotomy (12 %) to obtain satisfactory access, or a new medial approach can be used. In general, femoral bone loss does not pose a problem. In greater than 90 % of cases a standard femoral component was used in both PS and CR prostheses. Effectively, when preparing the femur the cuts are made in addition to the old UKA cuts which are always thinner than those of a TKA (5–6 mm against 8–10 mm). The previous anchoring holes from the old implant sometimes persist but these can be filled with either cement or crushed bone. The only difficulty is in inserting the femoral intramedullary guide in such a way as to prevent too great a cut on the side where the previous prosthesis had been placed. When applying the cutting block it is also important to avoid excessive external rotation (medial prosthesis) or internal rotation (lateral prosthesis). To avoid this, we suggest applying a block of the same thickness as the old prosthesis to the posterior condyle to provide an accurate reference point. Managing tibial bone loss is more difficult. In 49.6 % of cases a standard prosthesis was used without difficulty. When selecting a prosthesis, it is important to assess bone loss preoperatively by radiography or even computed tomography. Cuts made on the untreated side must not exceed 12–14 mm in order to avoid exposing poor quality cancellous bone and being too close to the tibial tuberosity or Gerdy’s tubercle. If this is likely to occur, a smaller cut of around 10 mm should be made and a unilateral metallic augment used to compensate for the bone loss. Augments are available in sizes up to 14–15 mm high depending on the manufacturer. Some authors [26] have preferred to use femoral head allograft. This is particularly useful when bone loss has exceeded 20 mm (10 mm of tibial plateau height and 10 mm of metallic augment). This technique was used nine times in our series. In principle, in cavitory bone loss (type 1 and 2A), defects can be filled with either small

cancellous grafts from waste bone cuts or with cement [17, 20]. In cases of segmental bone loss, metallic augments, segmental allograft or screw augmentation sunk in cement can be used [17]. There are no absolute rules, but the aim is to reconstruct the bone stock whilst preventing future mechanical failure of the prosthesis. In order to achieve this, it is also useful to use a cemented or uncemented longer keeled prosthesis. This can prevent any potential tilting or subsidence of the tibial plateau, particularly in cases of poor bone quality. In this series, 18 keeled tibial prostheses were used and 18 femoral keeled prostheses were used. With regard to rotating hinge prostheses, these were only used by one participating centre in some of the earliest cases in the series. The use of such implants should be reserved for exceptional cases.

Conclusion

Revision of partial knee replacements is common and failures are multifactorial. Before planning revision of such implants careful consideration must be given to the cause of failure in order to select the most appropriate surgical strategy. Revision to a TKA is not the only option but is the most frequently used. Arthroscopy can be used both for removing excess cement and as a diagnostic tool. Partial revisions replacing a UKA with another or by resurfacing the contralateral side in carefully selected patients and in experienced hands are less invasive techniques that warrant consideration.

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