Short Uncemented Femoral Component for Hip Revision: Prognosis and Risk Factors Associated With Failure

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Research article

Keywords: Femoral Component, Associated With Failure, osteoporosism, intraoperative periprosthetic femoral

Posted Date: November 5th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-101462/v1

Version of Record: A version of this preprint was published at BMC Surgery on April 13th, 2021. See the published version at https://doi.org/10.1186/s12893-021-01196-1.

Abstract

Background

The application of short uncemented femoral stem is partially restricted in revision surgery. In some patients with mild to moderate bone deficiency, short uncemented stem is certainly a choice. This study will demonstrate the therapeutic effect and unsuitable situation for short uncemented stem revision.

Methods

Patients who undergone hip revision from January 2005 to December 2015 were retrospectively analyzed in this study. Preoperative radiological images were evaluated to help estimating the bone deficiency around hip joint. Mann-Whitney U test was performed for comparison between continuous variables. Chi-square test was performed for comparison between categorical variables. Cox regression analysis was used to assess the association between potential risk factors and failure of revision surgery.

Results

A total of 381 patients were retrospectively reviewed. The mean follow-up time was 71.05±16.54 months. The mean time from primary revision surgery to secondary revision surgery was 16.41±17.47 months. According to the survival status of femoral component at final follow-up, patients were divided into two groups. Cox regression analysis revealed that the risk for revision failure approximately increased by 5.6% for every year of age increase (HR=1.056, 95%CI=1.012–1.102). Osteoporosis was another independent risk factor for revision failure (HR=2.802, 95%CI=1.097–7.157). The strongest risk factor was intraoperative periprosthetic femoral fracture during revision surgery in this study (HR=5.477, 95%CI=2.156–13.913).

Conclusion

Three risk factors for failure are identified, such as aging, osteoporosis and intraoperative periprosthetic femoral fracture during revision surgery. Therefore, short uncemented femoral stem should be implanted in these patients with additional caution.

1. Background

Reconstruction of the proximal femur and femoral component implantation is one of the most important processes during hip revision. Traditionally, a lengthened femoral stem could be chosen to achieve stable fixation which is original from the press-fit between the stem and the distal femur [1]. However, there are some disadvantages of this surgical method which might largely compromise the prognosis of patients. First, due to the physiological curvature of the femur, some lengthened diaphyseal fixation stems have a self-curvature design [2]. The mismatch between the stem and femur might result in the implantation difficulty of the stem and intraoperative femoral fracture [3]. Second, if the prognosis of primary revision is not satisfied, secondary revision surgery might be performed. In this situation, existed distal fixation stem might bring great challenge during the implantation process of the new femoral component [4]. Finally, more than anything, the stress shielding effect at proximal femur could be very strong after implantation of a lengthened diaphyseal fixation stem. This will lead to bone resorption, osteolysis and bone remodeling of proximal femur after revision surgery, leaving a large bone deficiency and even causing aseptic loosening of the stem [5]. Therefore, how to preserve the proximal femoral bone mass is crucial important for hip revision.

Recently, the short uncemented stem is more commonly chosen in primary arthroplasty. These stems are characterized as trochanteric bone preserving design, distal polishing and metaphyseal press-fit fixation. Theoretically, the stress shielding effect of proximal femur could be largely reduced in patients implanted with short uncemented stem [6]. For this reason, if short uncemented stem could be used for revision surgery, the proximal femoral bone mass is expected to be increased postoperatively after bone grafting [7]. However, the problem is that how do these stems achieve early stability without fixation from distal femur. Furthermore, in patients with serious bone deficiency (e.g. Paprosky Type III-B or Type IV), the proximal femur might be completely absented. In this situation, short stem could not obtain enough press-fit fixation to achieve early stability [8,9].

Although the application of short uncemented femoral stem is partially restricted in revision surgery. In some patients with mild to moderate bone deficiency, short uncemented stem is certainly a choice. However, the number of reports regarding on revision surgery with short uncemented femoral stem is limited [10,11]. We have performed some hip revisions with short femoral stem in patients with Paprosky Type I, Type II and Type III-A femoral bone deficiency. In this study, these patients are retrospectively reviewed. The follow-up time are at least 5 years. We focus on the prognosis of patients and risk factors for failure. We believe this study will demonstrate the real therapeutic effect, as well as the unsuitable situation for short uncemented stem revision.

2. Methods

2.1. Study Population

Patients who undergone hip revision from January 2005 to December 2015 were retrospectively analyzed in this study. The inclusion criteria were patients undergone uncemented hip revision surgery with short femoral component (in this study, Tri-Lock from DePuy was chosen). Note that "revision" in this study meant that the removing of the original hip prostheses (the femoral component or spacer must be removed) as well as the implantation of the new hip prostheses. In some patients, the acetabular component was retained. But the femoral component was replaced. These patients were also included in our study. The exclusion criteria were as following: (1) "standard" metaphyseal-diaphyseal fixation femoral component (e.g. Corail from DePuy, Link Classic Uncemented from LINK) or diaphyseal fixation femoral component (e.g. Solution from DePuy, Wagner SL from Zimmer) was implanted; (2) cemented femoral component revision; (3) isolated acetabular component revision failure postoperatively; (4) lost of follow-up or decline to participate in this study. The study was approved by the Institutional Review

Board of the Third Hospital of Hebei Medical University and was conducted in accordance with the Declaration of Helsinki and regulations of the Health Insurance Portability and Accountability Act (HIPAA). Written informed consent was obtained from the patients prior to their participation in this study (before the last follow-up). Demographic information, characteristics of primary arthroplasty and other radiological and clinical data were obtained from the medical records and the Picture Archiving and Communication Systems (PACS) of our institute.

2.2 Surgical Process

All the revision surgeries were performed by one group of surgeons. Preoperative radiological images were evaluated to help estimating the bone deficiency around hip joint. In this study, we focused on femoral bone deficiency. Hence, femoral bone deficiency was classified according to Paprosky classification system. The surgical process was briefly described as following. First, the hip joint was clear exposed via anterior or posterior approach. The approach was selected according to the habits of surgeon. During this process, redundant fibro-scar tissue was removed. Then, after dislocated the joint prosthesis, the stabilities of both acetabular component and femoral component were evaluated. The femoral component would be removed firstly to help exposing the acetabular component. If the acetabular component was considered to be loosen, it would be removed from the bone socket. After acetabular bone grafting, a new acetabular shell and liner would be implanted. Next, the proximal femur would be exposed. The surgeon should evaluate the bone deficiency of proximal femur, which helps to determine the proper kind of femoral stem for revision. In this study, only patients with Paprosky Type I, Type II and Type III-A bone deficiency were chosen to implant short femoral stem. If cemented femoral stem had been used in primary arthroplasty, the bone cement was removed prior to bone grafting and stem implantation. Of course, in some patients, bone cement might not be completely removed. The next step was preparing of the medullary canal. Broaches were used to clear the medullary canal. Cancellous bone grafting was performed to help filling the bone deficiency. In some cases, structural bone grafting combined with internal fixation was also used to fill large bone deficiency. After preparing of the medullary canal, a short femoral stem (TriLock from Depuy) and prosthesis head was implanted (Figure 1). Then the joint was reduced and the incision was sutured.

All the patients were not allowed to have weight bearing within the first 3 weeks postoperatively, followed by a gradual increase in partial weight bearing to full weight-bearing in 12 weeks after surgery to ensure safety. Anticoagulants were used to prevent deep vein thrombosis.

2.3 Outcomes

The primary outcome of interest was the survival rate of the femoral stem at final follow-up. Risk factors for failure were also investigated. Secondary outcome of interest included the Harris hip score, excellent to good rate and incidence of complications. Note that if a revision surgery involving femoral component was performed in a patient, the last follow-up before secondary revision surgery was considered as the final follow-up.

2.4 Statistical analyses

Statistical analyses were performed using SPSS version 19.0 statistical software for Windows (IBM, Armonk, New York). Continuous variables were expressed as the mean±SD and categorical variables were expressed as frequencies. Mann-Whitney U test was performed for comparison between continuous variables. Chi-square test was performed for comparison between categorical variables. Cox regression analysis was used to assess the association between potential risk factors and failure of revision surgery. All the variables including general information, characteristics of primary arthroplasty and characteristics of revision surgical process were included in the regression models initially. By step-wise regression method, only final variables in equation were shown. A P value less than 0.05 was considered to be significant.

3. Results

3.1. General Information

A total of 381 patients were retrospectively reviewed. There were 188 males and 193 females. The average age and body mass index (BMI) before revision surgery was 58.85±13.46 years and 23.72±3.40 kg/m^2 respectively. Smoking and alcohol status, comorbidities and osteoporosis status were shown on Table 1. In terms of indication for revision, there were 256 patients with aseptic loosen, 21 patients with infection, 76 patients with recurrent dislocation, 26 patients with periprosthetic fracture and 2 patients with other reasons (one patient with serve thigh pain and one patient with fracture of the ceramic liner). According to the survival status of femoral component at final follow-up, patients were divided into two groups (patients with femoral stem survival and patients with femoral stem revision). Comparisons of general information between two groups were shown on Table 1.

3.2 Surgical Characteristics of Primary Arthroplasty

Primary hip disorders (indication for primary THA) were investigated in this study. Osteonecrosis of femoral head was the most predominant indication, which consisted 70% (269/381) of all the individuals. Other indications included avascular necrosis after internal fixation of femoral neck fracture, femoral neck fracture, osteoarthritis and hip dysplasia. Cemented fixations were performed in 212 individuals and uncemented fixations were performed in 169 individuals respectively. In terms of stem fixation segment, metaphyseal-diaphyseal fixation stem was most commonly chosen during primary THA. In most situations, polyethylene liner was implanted. Intraoperative periprosthetic femoral fractures were identified in 35 patients. Before revision surgery, femoral bone deficiency was classified according to Paprosky classification system. Detailed information regarding on surgical characteristics of primary arthroplasty and femoral bone deficiency was shown on Table 2.

3.3 Surgical Process of Revision

Most individuals received their surgeries via posterior approach. In 76 individuals, bone deficiency was limited after remove the original stem and cement, which allowed new stem implantation without bone grafting. In other patients, bone grafting was performed to reconstruct the bone deficiency. Cancellous bone grafting was independently performed in 268 patients, and was combined with structural bone grafting in 37 patients. Intraoperative periprosthetic femoral fractures were identified in 24 patients (8 patients with Vancouver Type A fractures and 16 patients with Vancouver Type B fractures). Because all the femoral stem used in this study was short, in 52 patients the distal end of the cement was not removed during revision surgery. In 8 patients with periprosthetic femoral fracture during primary THA, the internal fixation was removed during revision surgery. Characteristics of revision surgical process were summarized on Table 3.

3.4 Prognosis and Complications

The mean follow-up time was 71.05±16.54 months. Among all the 381 surgeries, femoral component survived in 359 surgeries at final follow-up. The mean Harris score is 85.36±12.43 at final follow-up. In 22 patients with poor results, secondary revision surgery was performed to remove the new implanted stem. The average time from primary revision surgery to secondary revision surgery was 16.41±17.47 months (range from 1 month to 63 months). The overall excellent-good rate is 80.84%. Complications were identified in 64 patients. The incidence of complications was 16.80%. Postoperative periprosthetic fractures were identified in 9 patients. All these patients experienced hip injures. According to Vancouver classification system, 6 patients were classified as Vancouver Type A. One patient was classified as Vancouver Type B. This patient received a secondary revision surgery, which replaced the unstable stem by using a diaphyseal fixation stem, as well as fixation of the fracture. Two patients were classified as Vancouver Type C. Occasional or recurrent prosthetic dislocations were identified in 20 patients. Superficial surgical site infections were identified in 5 patients. All these infections were healed after debridement and wound dressing. In 12 patients, aseptic loosen of the femoral stem were identified. These patients were also undergone secondary revision surgery. Mild to moderate (Brooker Grade 1-2) heterotopic ossifications were identified in 10 patients. No treatment was taken for these patients. In five patients, sign of bone grafting failure (resorption and osteolysis) were identified. If the stem was loosened after bone grafting failure, a secondary revision surgery was performed to remove the loosen stem and to implant the new lengthened stem. Detailed information regarding on prognosis and complications of patients were shown on Table 4.

3.5 Risk Factors for Failure

Three independent risk factors for failure of hip revision using short femoral stem were identified in this study. Aging was the first one. In this study, Cox regression analysis revealed that the risk for revision failure approximately increased by 5.6% for every year of age increase (HR=1.056, 95%CI=1.012–1.102). Osteoporosis was another independent risk factor for revision failure. Compared with patients without significant osteoporosis, those patients with osteoporosis were more 2.8-folds likely to fail in revision surgery with short femoral stem (HR=2.802, 95%CI=1.097–7.157). The strongest risk factor was intraoperative periprosthetic femoral fracture during revision surgery in this study (HR=5.477, 95%CI=2.156–13.913). If intraoperative periprosthetic femoral fracture was identified during revision process, the revision was probably expected to be failed in a short term. These independent risk factors, hazard ratios and 95% confidence intervals were shown on Table 5.

4. Discussion

In this study, the mid-term survival rate of femoral component was 94.23%, which was on the equivalent level than other similar studies. Chatelet et al [12] has reported that the mid-term survival rate was 96.7% of a long uncemented monobloc stem for revision total hip arthroplasty. McInnes et al [2] has also reported similar survival rates of two femoral components for hip revision surgery, which were 87.1% and 87.8% at 15 years follow-up. This demonstrated the applicability of short stem in patients undergoing hip revision surgery. But there were still some complications which might compromise the prognosis of patients. The main reason for re-revision was aseptic loosen, followed by bone grafting failure and recurrent-dislocation. In patients undergoing hip revision surgery, osteosclerosis and osteolysis could commonly be identified on proximal femur, especially on metaphyseal segment [13]. Meanwhile, loss of cancellous bone would reduce the press-fit effect of the stem. These might potentially increase the incidence of aseptic loosen [14]. In addition, allografting was performed in this study. In elderly patients with osteoporosis, bone grafting failure might occur, also causing the loosen of femoral stem [7,15].

Three risk factors for revision failure were identified in this study. The first one is aging. As it has already been well established, aging is a certain factor associated with bone strength decreasing, fragility and osteoporosis [16,17]. Furthermore, osteogenesis is also largely affected by aging, especially for hip joint. Studies have shown that femoral neck fracture could hardly achieve bony union in elderly patients [18-20]. In patients undergoing hip revision, bone grafting is commonly performed to help filling the bone deficiency of proximal femur. Meanwhile, impaction bone grafting also plays an important role which helps stabilizing the femoral stem. In elderly patients, graft bone (especially allograft) might not survive. This will cause bone resorption around femoral stem and culminate in an aseptic loosen of the stem. In this study, all patients were implanted with short uncemented stem, which means the stem stability is largely relied on the success of bone grafting. If bone grafting failed, stem loosen is prone to be occurred. Some related studies have similar findings. Lamb et al [11] had reported that increasing age (hazard ratio, 1.02 per year) was associated with failure of cemented stem implantation after periprosthetic femoral fracture after primary total hip arthroplasty. Cantrell et al [21] also found that Increasing age was significant positively associated independent risk factors for incidence of complications and 30-day readmission. Dale et al [10] reported that uncemented hip arthroplasties in women of age 55-75 years and over 75 years of age had higher risk of revision (mainly due to periprosthetic fracture and dislocation) compared with cemented arthroplasties. Thus, for elderly patients, hip revision with short uncemented stem is a delicate problem.

The second risk factor is osteoporosis. In this study, bone density of patient was measured by dual-energy x-ray absorptiometry. Due to the interference from metal hip prostheses, bone density of lumbar vertebrae was measured. Osteoporosis of patient was diagnosed according to the criteria from World Health Organization (T<-2.5). Comparing to those patients with normal bone mineral density, the risk of revision failure in patients with significant osteoporosis was 2.8-fold higher when short uncemented stem was implanted. As we known, the initial stability of uncemented prosthesis is depended on the press-fit between the prosthesis and the bone socket [22]. That means the minimal anti-rupture strength of the proximal femur must exceed the pressure between the femoral stem and the medullary canal which is required for stable press-fit of the prosthesis. In patients with osteoporosis, the bone strength decreases, which might cause failure of press-fit between prosthesis and medullary canal. Thus, in patients with serious osteoporosis, cemented prosthesis should be implanted rather than uncemented prosthesis. In this study, all patients received uncemented revision, which means there might be osteolysis, osteosclerosis and bone deficiency around proximal femur. If the patient was combined with osteoporosis, incidence of press-fit failure and proximal femoral periprosthetic fracture might be increased, leading to failure of the revision surgery. Furthermore, in patients with osteoporosis, the bone grafting might not survive, which could also cause revision failure. Therefore, in patients with osteoporosis, cemented revision should be taken into account.

The strongest risk factor for revision failure in this study is intraoperative periprosthetic femoral fracture during revision surgery. Several reports [23,24] have shown that, comparting to primary hip arthroplasty, hip revision is associated with increased incidence of periprosthetic femoral fracture. Some other studies have shown that comparing with “standard” femoral stem which chartered as metaphyseal-diaphyseal fixation, these short stems are commonly associated with increased incidence of intraoperative periprosthetic femoral fractures. Moreover, periprosthetic femoral fracture is a potential cause of complications. Panula et al [25] reported that periprosthetic fractures were associated with increased risk of revision for dislocation after total hip arthroplasty. Devane et a [26] and Liu et al [27] also reported that intraoperative periprosthetic femoral fractures were commonly accompanied with poor clinical outcomes of patients. In this study, the femoral component was characterized as metaphyseal fixation and distal end polishing design. That means the integrity of local segment of proximal femur is crucial important for the press-fit and stability of the stem. Suppose that intraoperative periprosthetic fracture occurs and the metaphyseal segment of femur between greater trochanter and less trochanter is involved in, there might be no enough press-fit force for stable fixation of stem. In this situation, the stem is prone to be loosen regardless of internal fixation for periprosthetic fracture. We have a typical case shown on Figure 2. On the contrary, if this situation occurs when a “standard” femoral component is implanted, the distal press-fit fixation will provide stability for the prosthesis. Therefore, if intraoperative periprosthetic femoral fracture is identified during revision surgery with short femoral stem, we strongly recommend an immediate revision with long stem (metaphyseal-diaphyseal fixation stem or diaphyseal fixation stem) rather than isolated fracture fixation.

This study has several limitations. First, due to the metaphyseal fixation of short stem, only patients with Paprosky Type I, Type II and Type III-A bone deficiency were included in this study. This will make our study incomparable with other studies which might involve patients with serious bone deficiency (e.g. Paprosky Type III-B or Type IV). Second, isolated acetabular component revision failure postoperatively was excluded from this study. Hence, the overall survival rate of femoral stem might be affected. Third, the sample size was relatively small. Other potential risk factors might not be identified in this study.

5. Conclusion

Our study provides detailed information regarding on prognosis of patients undergoing hip revision with short uncemented femoral component. The mid-term result shows that the survival rate for femoral component is 94.23%. Three risk factors for failure are identified, such as aging, osteoporosis and intraoperative periprosthetic femoral fracture during revision surgery. Therefore, short uncemented femoral stem should be implanted in these patients with additional caution.

Abbreviations

HIPAA, Health Insurance Portability and Accountability Act

PACS, Picture Archiving and Communication Systems

BMI, body mass index

THA, total hip arthroplasty

Declarations

Ethics approval and consent to participate

This study was approved by the Institutional Review Board of the Third Hospital of Hebei Medical University and was conducted in accordance with the Declaration of Helsinki. As this was a retrospective study and all patient information was deidentified before analysis, informed consent was only required for patients whose radiological images would be published.

Consent for publication

Written informed consent was obtained from participants whose radiological data have been published in the journal.

Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Competing interests

All the authors declare that they have no conflict of interest with any organization that sponsored the research.

Funding

Not applicable.

Authors’ contributions

All authors have read and approved the manuscript.

Conceptualization: ZML, YTH, BL

Data curation: BL, TW, BSZ, SKL, JH

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Acknowledgments

Not applicable.

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Tables

Table 1. General Information of Patients undergoing Revision Surgery with Short Uncemented Femoral Component

Characteristics of Patients	Femoral Stem Survival (n=359)	Femoral Stem Revision (n=22)	Total (n=381)	Statistics Value	P
Gender					
Male	178	10	188	0.141#	0.707
Female	181	12	193		
Age (years)	58.15±13.22	70.23±12.45	58.85±13.46	-4.097*	<0.001
Body Mass Index (kg/m^2)	23.72±3.42	23.73±3.18	23.72±3.40	-0.032*	0.975
Smoking					
No	317	20	337	0.138#	0.710
Yes	42	2	44		
Alcohol Consumption					
No	310	20	330	0.371#	0.542
Yes	49	2	51		
Diabetes					
No	320	20	340	0.068#	0.795
Yes	39	2	41		
Rheumatism					
No	341	21	362	0.010#	0.922
Yes	18	1	19		
Osteoporosis					
No	325	13	338	20.463#	<0.001
Yes	34	9	43		
Indication for Revision					
Aseptic Loosen	240	16	256	1.522#	0.841
Infection	19	2	21		
Recurrent Dislocation	73	3	76		

Periprosthetic Fracture	25	1	26
Other	2	0	2

*Mann-Whitney U test

#Chi-square test

Table 2. Primary Surgical Characteristics and Femoral Bone Deficiency of Patients undergoing Revision Surgery with Short Uncemented Femoral Component

Characteristics of Patients	Femoral Stem Survival (n=359)	Femoral Stem Revision (n=22)	Total (n=381)	Statistics Value	P
Indication for Primary THA					
Osteonecrosis	253	16	269	5.130#	0.400
Avascular Necrosis	20	0	20		
Femoral Neck Fracture	49	5	54		
Osteoarthritis	24	1	25		
Hip Dysplasia	9	0	9		
Other	4	0	4		
Fixation Feature of Primary THA					
Cemented	200	12	212	0.011#	0.915
Uncemented	159	10	169		
Femoral Stem Fixation Segment					
Metaphyseal	21	1	22	2.680#	0.262
Metaphyseal-Diaphyseal	317	21	338		
Diaphyseal	21	0	21		
Periprosthetic Femoral Fracture during Primary THA					
No	327	19	346	0.554#	0.457
Yes	32	3	35		
Bearing					
Metal (Ceramic)-Polyethylene	319	18	337	1.006#	0.316
Ceramic-Ceramic	40	4	44		
Femoral Bone Deficiency (Paprosky Classification)					
Type I	186	11	197	0.235#	0.889
Type II	149	10	159		
Type III-A	24	1	25		

Type III-B	0	0	0
Type IV	0	0	0

THA, total hip arthroplasty

#Chi-square test

Table 3. Characteristics of Revision Surgical Process of Patients undergoing Revision Surgery with Short Uncemented Femoral Component

Characteristics of Patients	Femoral Stem Survival (n=359)	Femoral Stem Revision (n=22)	Total (n=381)	Statistics Value	P
Approach					
Posterior	326	22	348	2.214#	0.137
Anterior	33	0	33		
Femoral Bone Grafting					
None	71	5	76	0.751#	0.687
Non-Structural	252	16	268		
Structural	36	1	37		
Intraoperative Periprosthetic Fracture					
No	342	15	357	25.760#	<0.001
Yes	17	7	24		
Residual Bone Cement					
No (or not applicable)	312	17	329	1.633#	0.201
Yes	47	5	52		
Femoral Internal Fixation Remove					
No (or not applicable)	351	22	373	0.501#	0.479
Yes	8	0	8		

#Chi-square test

Table 4. Prognosis and Complications of Patients undergoing Revision Surgery with Short Uncemented Femoral Component

Characteristics of Patients	Count (n)	Proportion (%)
Harris Score		
Excellent	149	39.11
Good	159	41.73
Fair	51	13.39
Poor	22	5.77
Complications		
Periprosthetic Fracture	9	2.36
Dislocation	16	4.20
Recurrent-Dislocation	4	1.05
Infection	5	1.31
Aseptic Loosen	12	3.15
Heterotopic Ossification	10	2.62
Bone Grafting Failure	5	1.31
Other	1	0.26
Survival of Femoral Component		
No	359	94.23
Yes	22	5.77

Table 5. Independent Risk Factors for Early Failure of Patients undergoing Revision Surgery with Short Uncemented Femoral Component

Risk Factors (Independent)		Hazard Ratio	95% Confidential Interval for Hazard Ratio	P
Age (years)		1.056	1.012-1.102	0.012
Osteoporosis	No (Ref.)			
	Yes	2.802	1.097-7.157	0.031
Intraoperative Periprosthetic Femoral Fracture	No (Ref.)			
	Yes	5.477	2.156-13.913	<0.001

Note: only variables in equation are shown in the table.

Figures

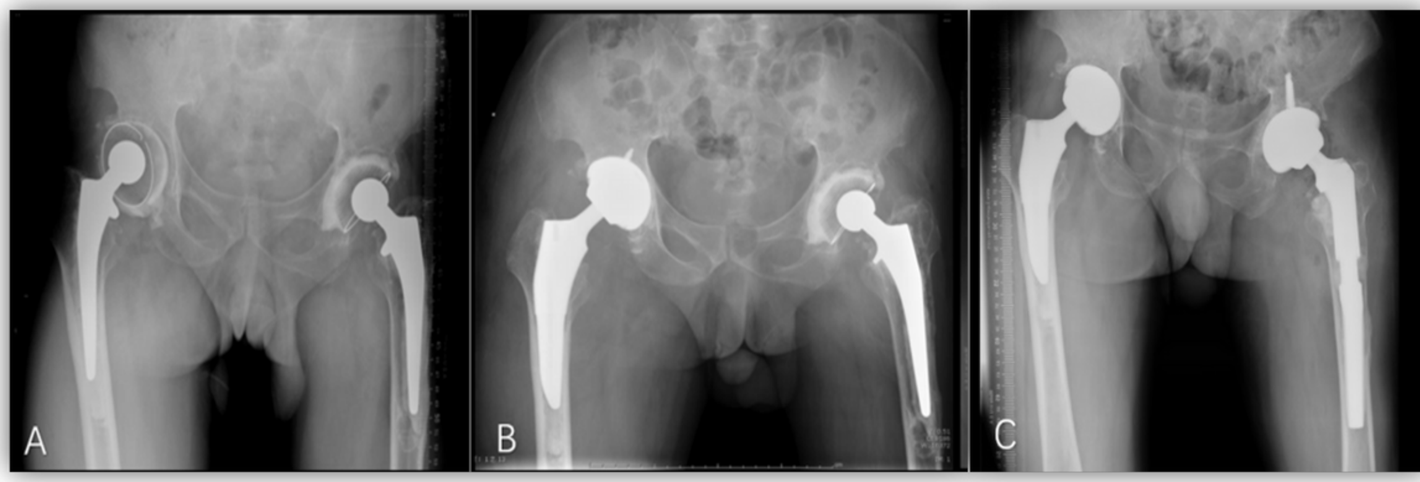

Figure 1

A 50-60 years old (sex 1) patient with bilateral hip prosthesis aseptic loosen had undergone bilateral primary total hip arthroplasties eight years ago. Cemented prostheses had been implanted in both of his hips. In this study, the patient received right hip revision surgery, with uncemented acetabular and femoral component. Satisfied function recovery could be identified during the follow-up period. Complication or significant stem loosen was not found at last follow-up. (A) Before revision, aseptic loosen of the prostheses could be found in bilateral hips of the patient. (B) After revision, uncemented short stem was implanted. (C) Last follow-up, the prosthesis was stable with satisfied function recovery.

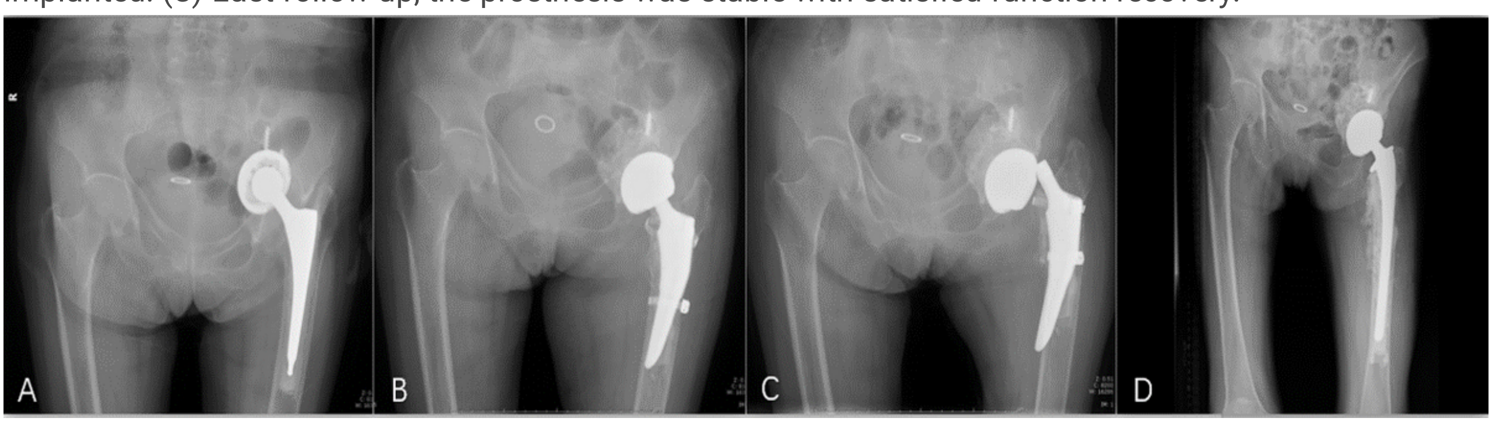

Figure 2

A 60-70 years old (sex 2) patient with aseptic loosen of left hip prosthesis had undergone primary total hip arthroplasty one year ago. Uncemented acetabular component and cemented femoral component had been implanted. The patient received uncemented left hip revision surgery. A periprosthetic femoral fracture occurred during the revision process, which was fixed with two cables. Five weeks after revision surgery, aseptic loosen with dislocation between the prosthetic head and femoral stem was identified, which declared the failure of the uncemented revision surgery. Finally, the patient received a second revision surgery. A lengthened cemented stem was implanted to replace the loosen uncemented stem. No other complication was identified during the follow-up period. (D) Before first revision, an aseptic loosen of the prosthesis could be found. (E) Immediately after first revision, a periprosthetic femoral fracture could be identified. The fracture was fixed with two cables. (F) Five weeks after first revision, the stem was loosened. Dislocation between prosthetic head and femoral stem could also be identified. (G) After second revision, a lengthened cemented stem was implanted.