

EPIDEMIOLOGY OF REVISION OF TOTAL HIP ARTHROPLASTY IN FRANCE: A MULTICENTRE CASE SERIES OF 963 PATIENTS

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SUMMARY

Background: The incidence of total hip arthroplasty (THA) is increasing due to an aging population and expanded indications. Projections indicate a substantial rise in primary and revision procedures in France by 2050. Revision surgery presents significant clinical challenges, including higher complication rates and increased costs compared to primary arthroplasty.

Objective: This multicenter study aimed to analyze the epidemiology of THA revision in France and identify specific risk factors associated with revision failure, defined as subsequent re-operation or re-revision.

Key Points: A retrospective cohort of 963 patients was evaluated between 2015 and 2021. The overall failure rate was 14%, with infection accounting for 53% of these cases. Primary indications for revision included aseptic loosening (35.6%), periprosthetic fracture (32%), and prosthetic joint infection (15.2%). Statistical analysis identified younger age, revision iteration beyond the first ($R > 1$), and initial etiologies of infection or dislocation as significant risk factors for failure. The use of constrained liners and acetabular reinforcement devices was also associated with higher failure rates. Conversely, dual mobility components demonstrated a protective effect against failure, particularly in revisions performed for periprosthetic fractures. In revisions for dislocation, the failure rate reached 29%, primarily due to recurrent instability.

Conclusion: Infection remains the predominant cause of failure following THA revision. To optimize clinical outcomes and reduce the risk of instability, the routine use of dual mobility constructs is recommended in revision settings, including those involving periprosthetic fractures.

KEYWORDS

Arthroplasty, Replacement, Hip; Reoperation; Prosthesis-Related Infections; Periprosthetic Fractures; Hip Prosthesis

INTRODUCTION

Total hip arthroplasty surgery is continuously on the rise due to a broadening of the indications and the ageing population. Surgery is being performed on younger and younger, more active and more demanding patients [1]. While the initial goal of total hip arthroplasty was to relieve pain in an elderly population in end-stage hip osteoarthritis, the emphasis has shifted so that today the challenge is for the patient to be able to resume sporting activities [2],[3] and forget about their implant [4].

In France, between 2012 and 2018 the number of total hip arthroplasties (THA) performed rose by 10.5% with 150,060 primary surgeries and 19,457 revisions in 2018. Based on data from the French hospital discharge database (PMSI) and the characteristics of the French population, it is estimated that the number of interventions could see an increase of up to 98.3% between now and 2050 [5] bringing the numbers to around 300,000 primary THA per year. A 43% increase in revisions is predicted, equating to around 28,000 procedures per year. While the main national implant registries now provide reliable data on THA outcomes, they do not exhaustively document revisions due to reasons of numbers, chronology and the difficulty of linking a revision to a primary surgery [6]. Another difficulty results from the mix of terminology used, whether “revision”, “re-operation” or even “re-intervention” [7]. There have generally been few studies looking at all-cause THA revision outcomes and epidemiology, and certainly not in France.

In 2013, Delaunay et al. reported on a multicentre case series that looked at 2,107 cases of revision of primary THA. The leading cause of revision reported was still loosening (42%), but a significant increase was noted in revisions due to periprosthetic fracture (12%) and a fall in revisions due to dislocation (10%) [8].

Revision surgery is associated with more complications than primary surgery [9],[10] leading to greater costs [11] because of the increased length of stay, discharge more commonly to a rehabilitation and continued care unit than to home and an up to 5-fold higher rate of re-revision [12],[13]. For these reasons, it seems essential to understand why these revisions fail so that we can identify the areas of greater risk and prepare ourselves as well as possible for the current rise, and the rise to come, in revisions.

The main objective of this study is to analyse the epidemiology of THA revision in France, regardless of the aetiology and the revision iteration in order to identify the risk factors for failed revision. The secondary objective is to analyse the revision strategy in terms of the initial aetiology in primary revisions (R1), focusing on the four main aetiologies for revision: loosening, periprosthetic fracture, infection and dislocation.

METHOD

A retrospective, multicentre cohort study was carried out across three teaching hospitals in France (CHU Nîmes, CHU Lyon Sud, CHU Lyon Croix Rousse) where hip implant surgery is performed, including both primary and revision surgery. Every patient who had a revision total hip arthroplasty for any reason with a minimum of 1 year of post-operative follow-up was enrolled consecutively between 2021 and 2015.

We excluded cases of partial hip arthroplasty (hemiarthroplasty), revisions of partial hip arthroplasty for any reason, isolated repair of periprosthetic fracture, implants after failure of fracture repair, lavage without replacing the bearing surfaces and re-operations for any cause.

Revision was defined as a replacement of all or a part of the fixed implant structure. Re-operation was defined as any new event in the operating theatre, such as evacuation of a haematoma, periprosthetic fracture repair, iliopsoas tendon release, arthroscopic management of impingement or dislocation reduction. Re-revision was defined as a repeated revision of a failed surgery. The iteration of revision was defined as R1 for the first revision, R2 for the second revision, and so on for $R \geq 3$.

The data used were from each hospital's PMSI registry, using the following CCAM common medical coding: NEKA001, NEKA002, NEKA003, NEKA004, NEKA005, NEKA006, NEKA007, NEKA008, NEKA009, NELA001 and NELA002.

A senior surgeon directed data collection at each of the sites using a revision form drawn up by a committee of experts, to constitute a shared database. Surgical reports, radiography and medical records were reviewed to obtain the following information: patient demographic data, year of initial THA, revision iteration (R1, R2, $R \geq 3$), aetiology for revision, type of revision (one or two component revision or revision of the moving parts), surgical strategy (approach, implant type, fixation, bearing surfaces, graft), complications, re-operations, re-revisions and deaths.

The causes for revision were categorised as loosening (including wear osteolysis), periprosthetic fracture, infection, dislocation, adverse reaction to metal debris (ARMD), implant fracture, component malpositioning and leg length discrepancy (LLD), implant or soft tissue impingement, fixation abnormality, heterotopic ossification and noise.

Complications were categorised on the basis of whether they occurred during surgery, early (< 1 year) or late (> 1 year); the same categorisation was applied to early or late (< 1 year or > 1 year) re-revisions, re-operations and deaths.

The initial analysis looked at the entire case series to identify risk factors for failure, defined as re-operation or re-revision. To this end, the variables of interest were compared between two groups of patients: those who had presented a failure and those who had not. A second analysis looked at primary revisions (R1) to determine the typology of patients and of revision surgery strategy by four subgroups according to the initial aetiology for revision: fracture, loosening, infection and dislocation.

The primary endpoint in the full case series was failure.

The secondary endpoint was failure by aetiology for revision and surgical strategy in primary revisions (R1).

EasyMedStat© version 3.27 was used for the statistical analysis. The numerical variables were expressed as means (\pm standard deviations) and the discrete variables as absolute and relative frequencies (%). Two groups were created for the items "re-revision and re-operation". The comparability of the groups was assessed by comparing the baseline demographic data. The Shapiro-Wilk test was used to assess normality and the Levene test was used to test homogeneity of variance. The continuous results were assessed using an unmatched Student's t test, Welch's t test or the Mann-Whitney U test, depending on the distribution of the data. The discrete results were compared using a Chi2 test or Fischer's exact test, depending on the sample number. A 5% alpha risk was set and two-tailed tests were used.

RESULTS

General statistical picture

963 patients who had THA revision surgery between 2021 and 2015 were ultimately enrolled. The mean age was 72 years \pm 13.2 (14; 104), the sex ratio 0.81 with 55% women, mean BMI was 26.2 kg/m² \pm 5.3 [12.4; 50], mean year of index THA was 2007 [1976; 2021] and mean time to revision was 11.1 years \pm 9.8 [0; 45]. The distribution across the hospital sites is shown in the following diagram: 435 patients from Nîmes (45.2%), 305 from Lyon Sud (31.7%) and 223 from Lyon Croix Rousse (23.1%). (Table 1)

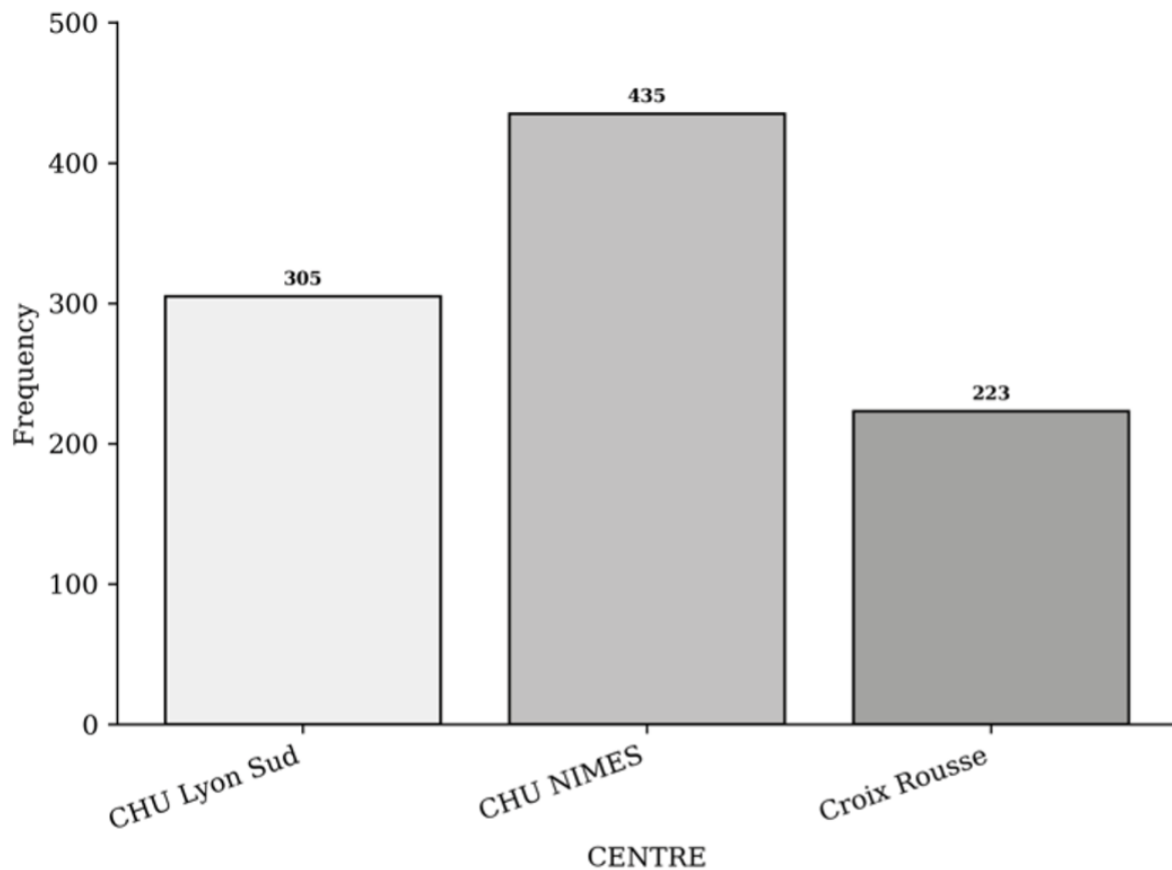


Table 1: Data by collection site.

There were 664 R1 primary revisions (69%), 196 R2 second revisions (20.3%) and 103 R \geq 3 third or later revisions (10.7%). (Table 2)

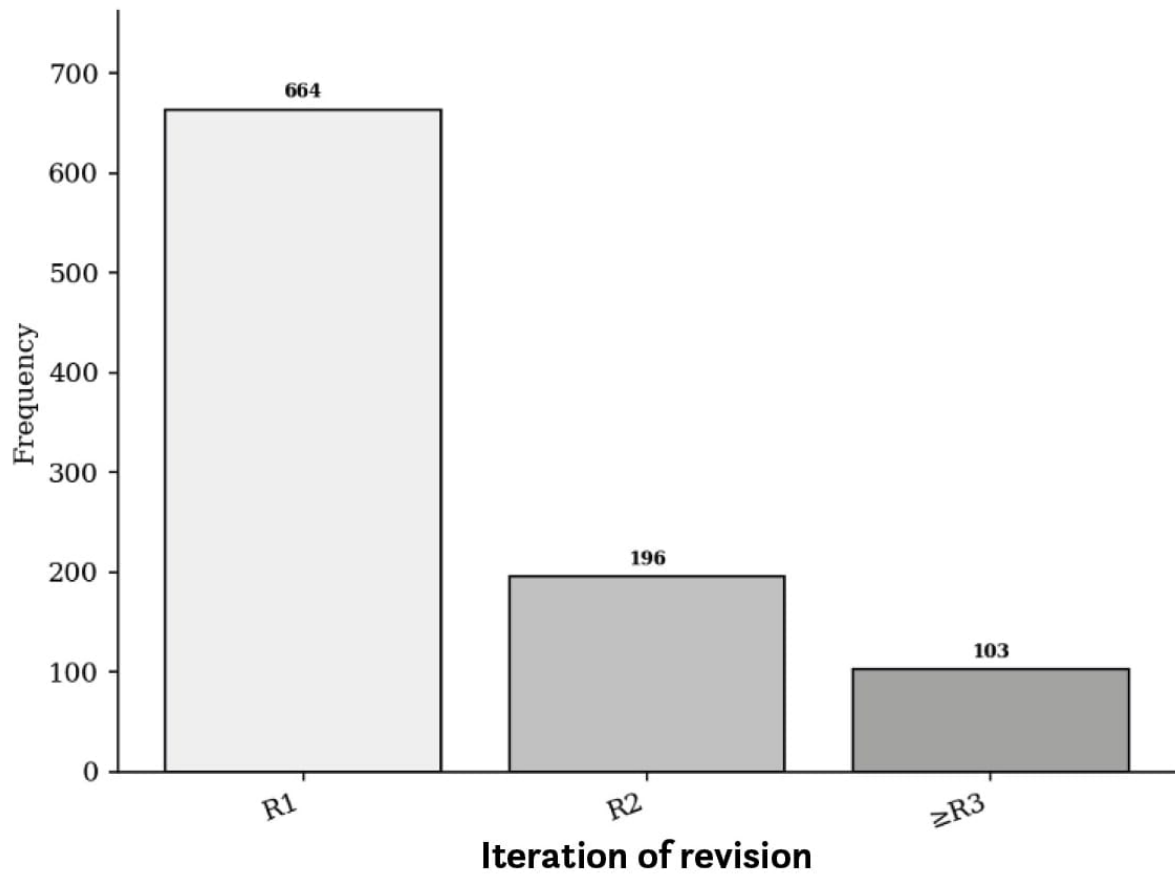


Table 2: Iteration of revision

Both components were revised in 53% of cases. (Table 3)

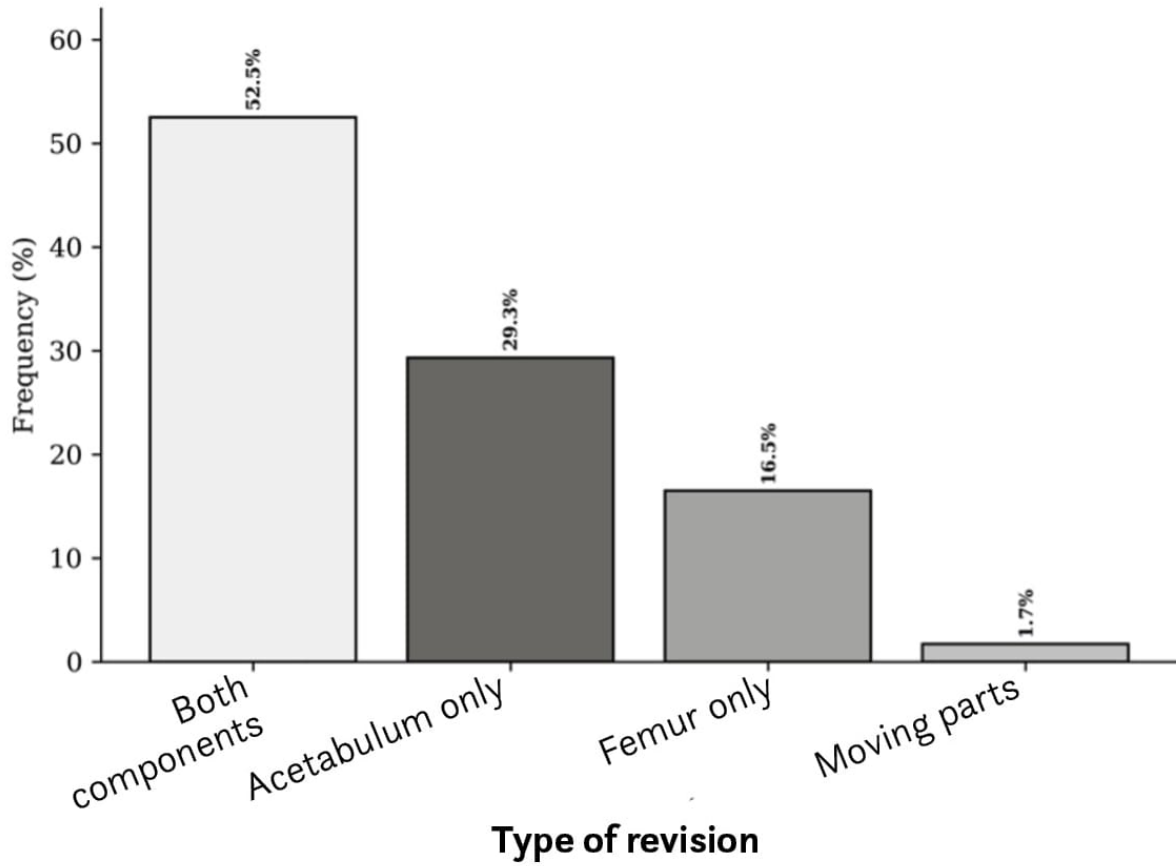


Table 3: Type of revision

Other causes (111, or 11.5%) divided as follows: (Table 4)

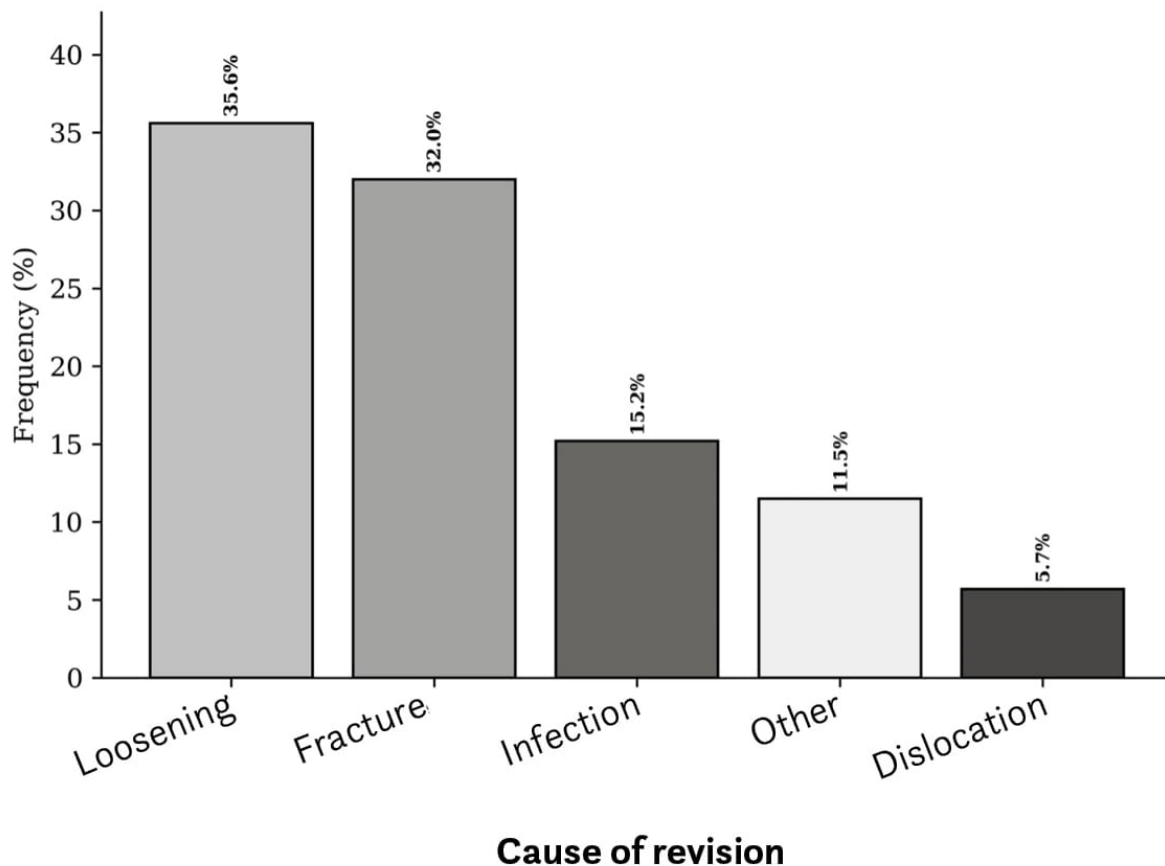


Table 4: Causes of revision

- Soft tissue or component impingement (34, or 3.5%)
- Fixation abnormalities (28, or 2.9%)
- Component malpositioning including LLD (20, or 2.1%)
- Implant fractures (14, or 1.5%)
- Adverse reaction to metal debris ARMD (12, or 1.2%)
- Noise (2, or 0.2%)
- Heterotopic ossification (1, or 0.1%)

Main analysis of failure

135 patients who underwent re-operation or re-revision were considered as having failed revisions, which gives a 14% failure rate for the whole case series. The cause of failure was infection in 53% of cases, 61% of which were “new infections”, meaning that patients underwent revision for a reason other than infection, but the revision was complicated by infection. This was the main cause of failure for all initial aetiologies for revision, except for revisions for dislocation, in which repeated dislocation (43.7%) was the main cause of failure.

The failure mode was early re-revision in 70% of cases. Out of these patients, 19 out of 94 presented with a subsequent complication, equating to a repeated failure rate of 20% for re-revisions in the first year. In 58% of cases, infection was the cause of repeated failure.

The failure rate by aetiology of initial revision, failure mode and cause of failure is set out in Table 5.

Aetiology of initial revision	Loosening	Fracture	Infection	Dislocation	Other	Total
	343	308	146	55	111	963
Failure rate by aetiology for revision	41/343	31/308	36/146	16/55	11/111	135/963
	12%	10,10%	24,70%	29%	9,90%	14%
Failure mode						
Re-operation	1 (2,5%)	5 (16,1%)	3 (8,3%)	4 (25%)	2 (18,2%)	15 (11,1%)
Re-revision < 1 year	29 (70,7%)	22 (71%)	29 (80,6%)	6 (37,5%)	8 (72,7%)	94 (69,6%)
Re-revision > 1 year	11 (26,8%)	4 (12,9%)	4 (11,1%)	6 (37,5%)	1 (9,1%)	26 (19,3%)
Cause of failure						
Loosening	7 (17,1%)	3 (9,7%)	1 (2,8%)	3 (18,8%)	3 (27,2%)	17 (12,6%)
Fracture	5 (12,2%)	4 (12,9%)	1 (2,8%)	1 (6,2%)	1 (9,1%)	12 (8,9%)
Infection	17 (41,4%)	18 (58,1%)	28 (77,8%)	5 (31,3%)	4 (36,4%)	72 (53,3%)
Dislocation	5 (12,2%)	5 (16,1%)	5 (13,8%)	7 (43,7%)	2 (18,2%)	24 (17,8%)
Other	7 (17,1%)	1 (3,2%)	1 (2,8%)	0	1 (9,1%)	10 (7,4%)
Repeated failure						
Loosening	1	0	0	0	0	1 (4,8%)
Fracture	1	0	0	0	0	1 (4,8%)
Infection	1	4	5	1	0	11 (52,4%)
Dislocation	3	0	3	1	0	7 (33,2%)
Other	0	0	0	0	1	1 (4,8%)
Rate of repeated failure	14,60%	12,90%	22,20%	12,50%	9,10%	15,60%

Table 5: Analysis of failures

There were 38 perioperative complications (8 false passages and 30 fractures). Six (1 false passage and 5 fractures) were followed by failure, while 32 were not ($p = 0.64$).

These 135 patients with failed revisions were compared to the 828 other patients in terms of the variables of interest in order to determine the risk factors for failure of revision. (Table 6)

Variable	Success	Failure	p-value
	828	135	
Sex			
Male	370 (44,7%)	62 (45,9%)	NS
Women	458 (55,3%)	73 (54,1%)	
Year of index THA	2007 ± 10,2 [1973 ; 2021]	2009 ± 9,2 [1984 ; 2021]	NS
Mean time to revision (years)	11,3 ± 10 [0 ; 45]	9,8 ± 8,8 [0 ; 31]	NS
Age	73 ans ± 13,5 [14 ; 104]	71 ans ± 10,6 [37 ; 94]	0.019
Weight (kg)	73,3 kg ± 17,9 [35 ; 155]	73,7 kg ± 17,6 [43 ; 127]	NS
BMI (kg/m2)	26,2 kg/m2 ± 5,4 [12,4 ; 50]	26,2 kg/m2 ± 5,3 [17 ; 44,3]	NS
Iteration of revision			
R1	588 (71%)	76 (56,3%)	< 0.001
R2	164 (19,8%)	32 (23,7%)	
R≥3	76 (9,1%)	27 (20%)	
Type of revision			
Both components	433 (52,3%)	73 (54,1%)	NS
Femur only	139 (16,8%)	20 (14,8%)	
Acetabulum only	245 (29,6%)	37 (27,4%)	
Moving parts	11 (1,3%)	5 (3,7%)	
Aetiology of revision			
Loosening	302 (36,5%)	41 (30,4%)	< 0.001
Periprosthetic fracture	277 (33,4%)	31 (23%)	
Infection	110 (13,3%)	36 (26,7%)	
Dislocation	39 (4,7%)	16 (11,8%)	
Other	100 (12,1%)	11 (8,1%)	
Approach			
Posterior	818 (98,8%)	133 (98,5%)	NS
Anterior	7 (0,8%)	2 (1,5%)	
Lateral	3 (0,4%)	0	
ETO			
Oui	53 (6,4%)	8 (5,9%)	NS
Non	775 (93,6%)	127 (94,1%)	
ETO fixation			
Cerclage wire	31 (58,5%)	7 (87,5%)	NS
Plate	22 (41,5%)	1 (12,5%)	
Acetabular component			
Standard cup	89 (10,7%)	16 (11,9%)	< 0.001
DM cup	735 (88,8%)	113 (83,7%)	
Constrained cup	4 (0,5%)	6 (4,4%)	
Fixation implant acétabulaire			
Ciment	164 (19,8%)	34 (25,2%)	NS
Sans ciment	664 (80,2%)	101 (74,8%)	
Acetabular reinforcement			
Kerboull plate or similar	112 (13,5%)	21 (15,6%)	0.011
Burch-Schneider cage	25 (3%)	11 (8,1%)	
Augment/custom-made	14 (1,7%)	0	
No	677 (81,8%)	103 (76,3%)	

Graft			
Allograft	174 (21%)	35 (25,9%)	NS
Autologous graft	77 (9,3%)	8 (5,9%)	
No	577 (69,7%)	92 (68,2%)	
Bearing surfaces			
Ceramic-PE	57 (6,9%)	10 (7,4%)	NS
Ceramic-Ceramic	26 (3,1%)	3 (2,2%)	
Metal-PE	745 (90%)	122 (90,4%)	
Femoral component			
Standard stem	364 (44%)	52 (38,5%)	NS
Long monoblock stem	187 (22,6%)	22 (16,3%)	
Long stem modular metaphysis	192 (23,2%)	42 (31,1%)	
Long stem modular neck	85 (10,2%)	19 (14,1%)	
Femoral component fixation			
Cemented	71 (8,6%)	12 (8,9%)	NS
Cementless	757 (91,4%)	123 (91,1%)	
Locking femoral component			
Yes	179 (21,6%)	30 (22,2%)	NS
No	649 (78,4%)	105 (77,8%)	
Perioperative complications			
False passage	7 (0,9%)	1 (0,7%)	NS
Fracture	25 (3%)	5 (3,7%)	
None	796 (96,1%)	129 (95,6%)	
Complication < 1 year			
Loosening	3 (0,4%)	10 (7,4%)	< 0.001
Fracture	5 (0,6%)	9 (6,7%)	
Infection	25 (3%)	68 (50,4%)	
Dislocation	10 (1,2%)	23 (17%)	
Other	13 (1,6%)	8 (5,9%)	
None	772 (93,2%)	17 (12,6%)	
Complication > 1 year			
Loosening	2 (0,2%)	8 (5,9%)	< 0.001
Fracture	0	4 (3%)	
Infection	6 (0,7%)	17 (12,6%)	
Dislocation	0	9 (6,7%)	
Other	7 (0,9%)	3 (2,2%)	
None	813 (98,2%)	94 (69,6%)	
Death			
< 1 year	27 (3,3%)	2 (1,5%)	NS
1-3 years	10 (1,2%)	4 (3%)	
> 3 years	3 (0,4%)	0	
No	788 (95,1%)	129 (95,5%)	

Table 6: Risk factors for failure

Young age ($p = 0.019$), iteration of revision $> R1$ ($p < 0.001$), the aetiologies infection and dislocation ($p < 0.001$), use of a constrained cup ($p < 0.001$) and an acetabular reinforcement device ($p = 0.011$), and the onset of early complications ($p < 0.001$) and late complications ($p < 0.001$) have been identified as risk factors for failure of revision. BMI, type of revision, approach route, trochanteric osteotomy, implant fixation, femoral implant, bone graft, bearing surfaces and perioperative complications were not found to have any impact. Nor was there any link between failure and death.

Subgroup analysis of 664 R1 revisions

1. Periprosthetic fractures

There were 286 R1 revisions due to periprosthetic fractures (43.1%), and these were compared to the 378 R1 revisions for other causes. In the fractures population, there were more women ($p = 0.008$), the mean time to revision was 8.7 years ($p = 0.036$) with a median time of 7 years, the mean age was higher (81 years; $p < 0.001$), weight and BMI were lower ($p < 0.001$), revisions were usually both components (58%) or femur only (34%) ($p < 0.001$), a long stem was used in 89% of cases ($p < 0.001$) that was cementless ($p < 0.001$) and locked in 39% of cases ($p < 0.001$), with no trochanteric osteotomy ($p = 0.005$) or graft ($p < 0.001$).

R1 revision due to periprosthetic fracture was associated with a lower rate of perioperative complications ($p = 0.045$), but a higher rate of death than with other causes (10% as against 1.6% $p < 0.001$), especially in the first year.

There was no difference in terms of early or late complications, or failure (re-operation, re-revision).

An analysis of failures in terms of the revision strategy for R1 for fractures showed that neither revision type, femoral implant nor bearing surfaces chosen had an impact on failure. However, there was a higher failure rate with a standard cup than with a dual mobility cup (20.5% as against 8.1%; $p = 0.036$). (Table 7)

Variable	R1 fracture 286	R1 other causes 378	p-value
Site			
Nîmes	170 (59.4%)	163 (43.1%)	< 0.001
Lyon Sud	113 (39.5%)	109 (28.9%)	
Croix Rousse	3 (1.1%)	106 (28%)	
Sex			
Male	105 (36.7%)	179 (47.4%)	0.008
Female	181 (63.3%)	199 (52.6%)	
Year of index THA	2010 ± 7.4 [1980 ; 2021]	2008 ± 9.7 [1976 ; 2021]	0.013
Mean time to revision (years)	8.7 ± 7.5 [0 ; 39]	10.6 ± 9.3 [0 ; 41]	0.036
Age	81 ans ± 10.7 [35 ; 104]	68 ans ± 12.9 [14 ; 94]	< 0.001
Weight (kg)	68.5 kg ± 16.1 [38 ; 145]	76.6 kg ± 18.9 [35 ; 155]	< 0.001
BMI (kg/m²)	25 kg/m ² ± 5.1 [15.4 ; 50]	27 kg/m ² ± 5.5 [12.4 ; 48.9]	< 0.001
Type of revision			
Both components	167 (58.4%)	177 (46.8%)	< 0.001
Femur only	98 (34.3%)	31 (8.2%)	
Acetabulum only	21 (7.3%)	159 (42%)	
Moving parts	0	11 (3%)	
Approach			
Posterior	281 (98.3%)	373 (98.7%)	NS
Anterior	3 (1%)	5 (1.3%)	
Lateral	2 (0.7%)	0	
ETO			
Yes	6 (2.1%)	27 (7.1%)	0.005
No	280 (97.9%)	351 (92.9%)	
ETO fixation			
Cerclage wire	5 (83.3%)	16 (59.3%)	NS
Plate	1 (6.7%)	11 (40.7%)	
Acetabular component			
Standard cup	38 (13.3%)	43 (11.4%)	NS
DM cup	248 (86.7%)	333 (88.1%)	
Constrained cup	0	2 (0.5%)	
Acetabular component fixation			
Cemented	43 (15%)	70 (18.5%)	NS
Cementless	243 (85%)	308 (81.5%)	
Acetabular reinforcement			
Kerboull plate or similar	38 (13.3%)	45 (11.9%)	NS
Burch-Schneider cage	4 (1.4%)	15 (4%)	
Augment/custom-made	1 (0.3%)	4 (1.1%)	
No	243 (85%)	314 (83%)	

Graft			
Allograft	47 (16,4%)	80 (21,2%)	< 0.001
Autologous graft	11 (3,9%)	40 (10,6%)	
No	228 (79,7%)	258 (68,2%)	
Bearing surfaces			
Ceramic-PE	30 (10,5%)	22 (5,8%)	0.02
Ceramic-Ceramic	5 (1,7%)	16 (4,2%)	
Metal-PE	251 (87,8%)	340 (90%)	
Femoral component			
Standard stem	32 (11,2%)	251 (66,4%)	< 0.001
Monoblock long stem	79 (27,6%)	67 (17,7%)	
Long stem modular metaphysis	98 (34,3%)	52 (13,8%)	
Long stem modular neck	77 (26,9%)	8 (2,1%)	
Femoral component fixation			
Cemented	10 (3,5%)	50 (13,2%)	< 0.001
Cementless	276 (96,5%)	328 (86,8%)	
Locking femoral component			
Yes	110 (38,5%)	34 (9%)	< 0.001
No	176 (61,5%)	344 (91%)	
Perioperative complications			
False passage	2 (0,7%)	4 (1%)	0.046
Fracture	3 (1,1%)	15 (4%)	
None	281 (98,2%)	359 (95%)	
Complication < 1 year			
Loosening	3 (1%)	5 (1,3%)	NS
Fracture	6 (2,1%)	4 (1,1%)	
Infection	20 (7%)	29 (7,7%)	
Dislocation	10 (3,6%)	9 (2,4%)	
Other	3 (1%)	8 (2,1%)	
None	244 (85,3%)	323 (85,4%)	
Complication > 1 year			
Loosening	3 (1%)	3 (0,8%)	NS
Fracture	1 (0,4%)	1 (0,3%)	
Infection	6 (2,1%)	6 (1,6%)	
Dislocation	0	4 (1,1%)	
Other	1 (0,4%)	7 (1,8%)	
None	275 (96,2%)	357 (94,4%)	
Death			
< 1 year	22 (7,7%)	5 (1,3%)	< 0.001
1-3 years	6 (2,1%)	1 (0,3%)	
> 3 years	1 (0,3%)	0	
No	257 (89,9%)	372 (98,4%)	
Re-revision			
Re-operation	7 (2,4%)	5 (1,3%)	NS
Re-revision < 1 year	16 (5,6%)	34 (9%)	
Re-revision > 1 year	4 (1,4%)	10 (2,7%)	
No	259 (90,6%)	329 (87%)	

Table 7: R1 for fractures compared to R1 for other causes

Examples of revision for periprosthetic fracture (PPF)

Case report n°1 (Figure 1)

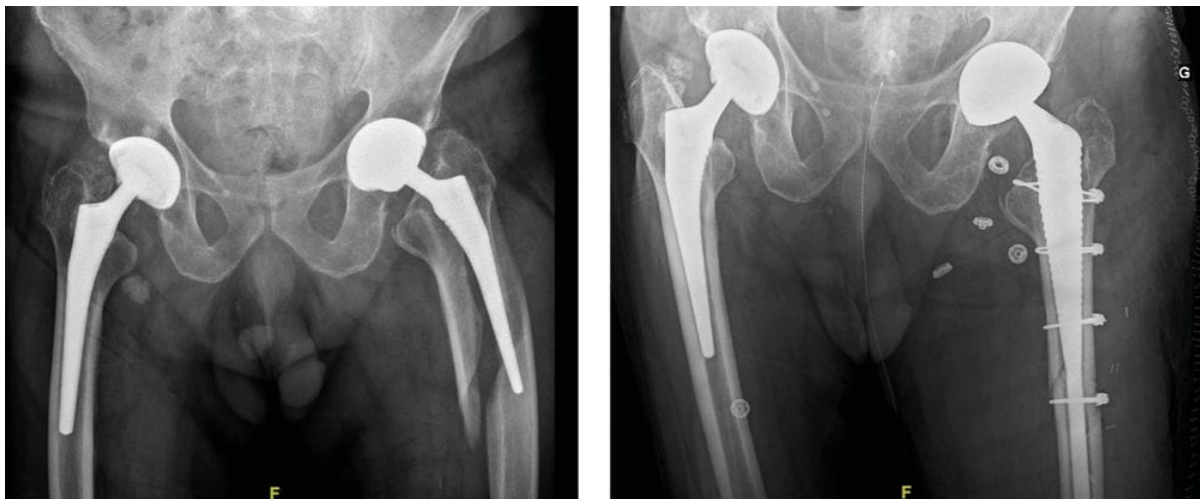


Figure 1: Two component revision due to PPF

- PPF at the cementless pivot (Vancouver B2)
- Two component revision: cementless monoblock long stem non-locking, fracture repair with cerclage wiring
- Dual mobility cup

Case report n°2 (Figure 2)

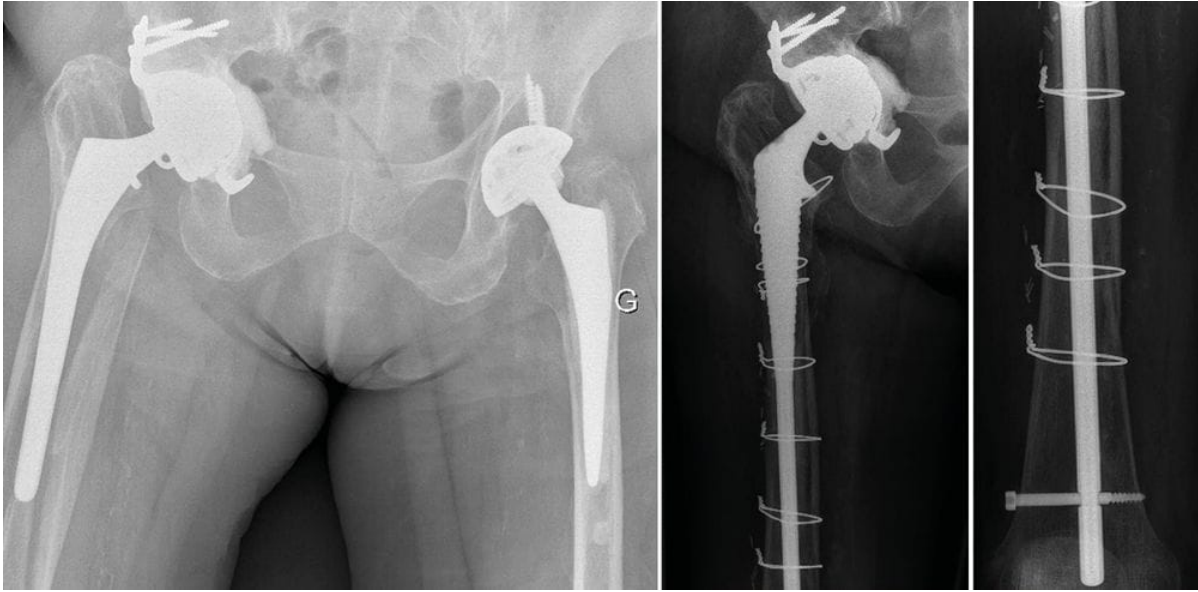


Figure 2: Femur-only revision due to PPF

PPF at the cementless pivot (Vancouver B2) after acetabulum-only revision

Femur-only revision: cementless monoblock long stem Locking stem, fracture repair with cerclage wiring.

2. Loosening

There were 199 R1 revisions due to loosening (30%), and these were compared to the 465 R1 revisions for other causes. In the loosening population, patients were younger at revision (69 years; $p < 0.001$), the mean time to revision was 15.2 years ($p < 0.001$) with a median time of 15 years, weight and BMI were higher ($p = 0.045$ and $p = 0.033$ respectively), revisions were acetabulum only (50%) or both components (42%) ($p < 0.001$), using acetabular reinforcement and a cemented cup in 26% of cases ($p < 0.001$) together with a bone graft ($p < 0.001$), and a standard stem was used in 63% of cases ($p > 0.001$).

There was no difference in terms of complications, failure, (re-operation, re-revision) or deaths.

An analysis of failures in terms of the revision strategy in R1 for loosening found that neither revision type, femoral implant, acetabular implant nor bearing surfaces chosen had an impact on failure. (Table 8)

Variable	R1 loosening	R1 other causes	p-value
	199	465	
Site			
Nîmes	73 (36,7%)	260 (55,9%)	< 0.001
Lyon Sud	70 (35,2%)	152 (32,7%)	
Croix Rousse	56 (28,1%)	53 (11,4%)	
Sex			
Male	96 (48,2%)	188 (40,4%)	NS
Female	103 (51,8%)	277 (59,6%)	
Age	69 ans ± 13,7 [14 ; 94]	76 ans ± 13 [18 ; 104]	< 0.001
Year of index THA	2003 ± 9,5 [1976 ; 2021]	2011 ± 7,4 [1980 ; 2021]	< 0.001
Mean time to revision (years)	15,2 ± 9,1 [0 ; 41]	7,4 ± 7,2 [0 ; 39]	< 0.001
BMI (kg/m²)	26,7 kg/m ² ± 4,9 [15,6 ; 44,3]	26 kg/m ² ± 5,6 [12,4 ; 50]	0.033
Type of revision			
Both components	84 (42,2%)	260 (55,9%)	< 0.001
Femur only	15 (7,5%)	114 (24,5%)	
Acetabulum only	100 (50,3%)	80 (17,2%)	
Moving parts	0	11 (2,4%)	
Approach			
Posterior	199 (100%)	455 (97,9%)	NS
Anterior	0	8 (1,7%)	
Lateral	0	2 (0,4%)	
ETO			
Yes	12 (6%)	21 (4,5)	NS
No	187 (94%)	444 (95,5%)	
ETO fixation			
Cerclage wire	5 (41,7%)	16 (76,2%)	NS
Plate	7 (58,3%)	5 (23,8%)	
Acetabular component			
Standard cup	21 (10,6%)	60 (12,9%)	NS
DM cup	178 (89,4%)	403 (86,7%)	
Constrained cup	0	2 (0,4%)	
Acetabular component fixation			
Cemented	51 (25,6%)	62 (13,3%)	< 0.001
Cementless	148 (74,4%)	403 (86,7%)	
Acetabular reinforcement			
Kerboull plate or similar	37 (18,6%)	46 (9,9%)	< 0.001
Burch-Schneider cage	9 (4,5%)	10 (2,6%)	
Augment/custom-made	3 (1,5%)	2 (0,5%)	
No	150 (75,4%)	407 (87,5%)	
Graft			
Allograft	66 (33,2%)	61 (13,1%)	< 0.001
Autologous graft	24 (12%)	27 (5,8%)	
No	109 (54,8%)	377 (81,1%)	
Bearing surfaces			
Ceramic-PE	11 (5,5%)	41 (8,8%)	NS
Ceramic-Ceramic	7 (3,5%)	14 (3%)	
Metal-PE	181 (91%)	410 (88,2%)	

Femoral component			
Standard stem	126 (63,3%)	157 (33,8%)	< 0.001
Monoblock long stem	42 (21,1%)	104 (22,4%)	
Long stem modular metaphysis	27 (13,6%)	123 (26,4%)	
Long stem modular neck	4 (2%)	81 (17,4%)	
Femoral component fixation			
Cemented	20 (10%)	40 (8,6%)	NS
Cementless	179 (90%)	425 (91,4%)	
Locking femoral component			
Yes	18 (9%)	126 (27,1%)	< 0.001
No	181 (91%)	339 (72,9%)	
Perioperative complications			
False passage	2 (1%)	4 (1%)	NS
Fracture	10 (5%)	8 (1,7%)	
None	187 (94%)	453 (97,3%)	
Complication < 1 year			
Loosening	3 (1,5%)	5 (1,1%)	NS
Fracture	1 (0,5%)	9 (1,9%)	
Infection	11 (5,5%)	38 (8,2%)	
Dislocation	6 (3,1%)	13 (2,8%)	
Other	5 (2,5%)	6 (1,3%)	
None	173 (86,9%)	394 (84,7%)	
Complication > 1 year			
Loosening	2 (1%)	4 (0,9%)	NS
Fracture	1 (0,5%)	1 (0,2%)	
Infection	2 (1%)	10 (2,2%)	
Dislocation	2 (1%)	2 (0,4%)	
Other	2 (1%)	6 (1,3%)	
None	190 (95,5%)	442 (95%)	
Death			
< 1 year	3 (1,5%)	24 (5,2%)	NS
1-3 years	1 (0,5%)	6 (1,3%)	
> 3 years	0	1 (0,2%)	
No	195 (98%)	434 (93,3%)	
Re-revision			
Re-operation	1 (0,5%)	11 (2,4%)	NS
Re-revision < 1 year	15 (7,5%)	35 (7,5%)	
Re-revision > 1 year	6 (3%)	8 (1,7%)	
No	177 (89%)	411 (88,4%)	
Re-revision			
Re-operation			
Re-revision < 1 year			
Re-revision > 1 year			
No			

Table 8: R1 for loosening compared to R1 for other causes

Examples of revision for loosening

Case report n°3

Female aged 65 at the consultation History of the illness:

- 1973: Fractured acetabulum. Fracture repair
- 1975: THA, complicated by dislocations
- 2000: First revision (R1) in 2 stages due to chronic infection: Kerboull cross-plate + cemented stem (Figure 3)

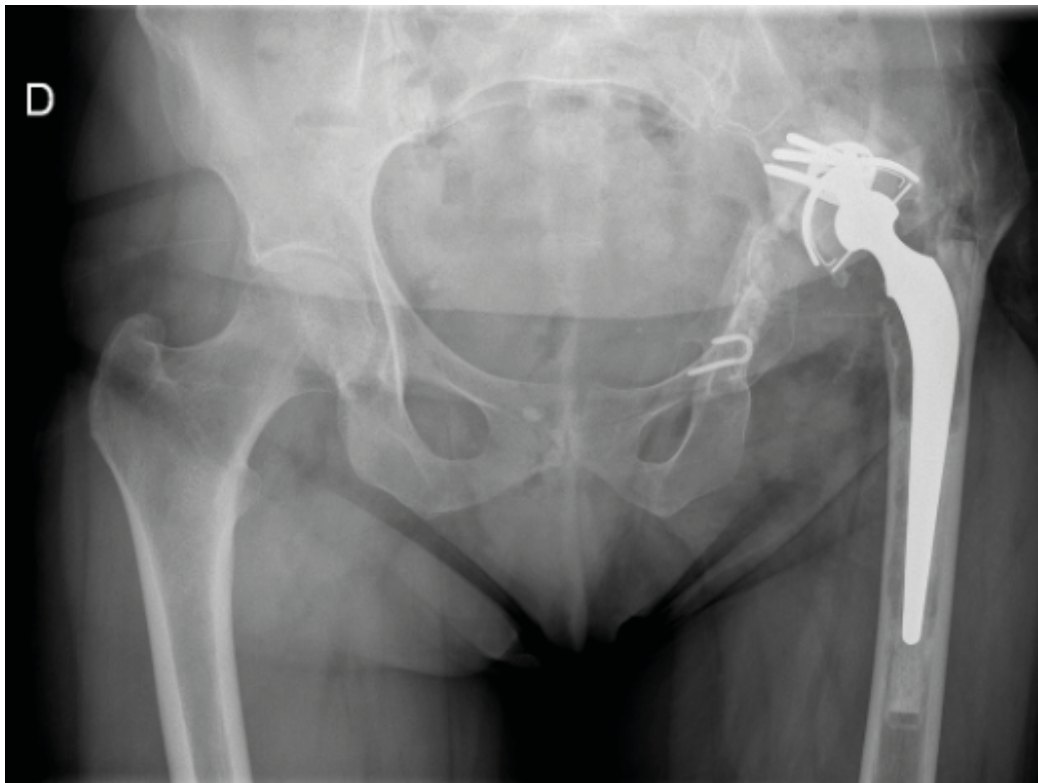


Figure 3: Acetabular loosening 1/4.

Clinical examination:

- Groin pain
- Unable to weight-bear
- -8 cm

Case report n°4 (Figure 4)

- Paprosky stage 3A acetabular loosening
- Charnley monoblock femoral stem
- Femoral osteolysis in zone 6-7

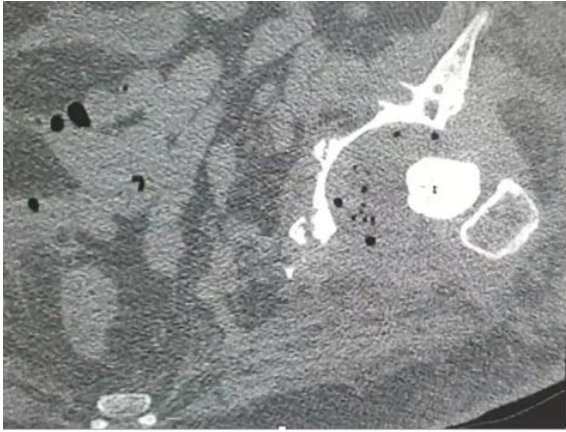


Figure 4: Acetabular loosening 2/4

Case report n°5 (Figure 5)

- Two-stage two component revision.
- 1 year post-surgery (Figure 6)
- LLD -5 cm
- Walks with a stick
- Slight limp TDB
- MF 3/5

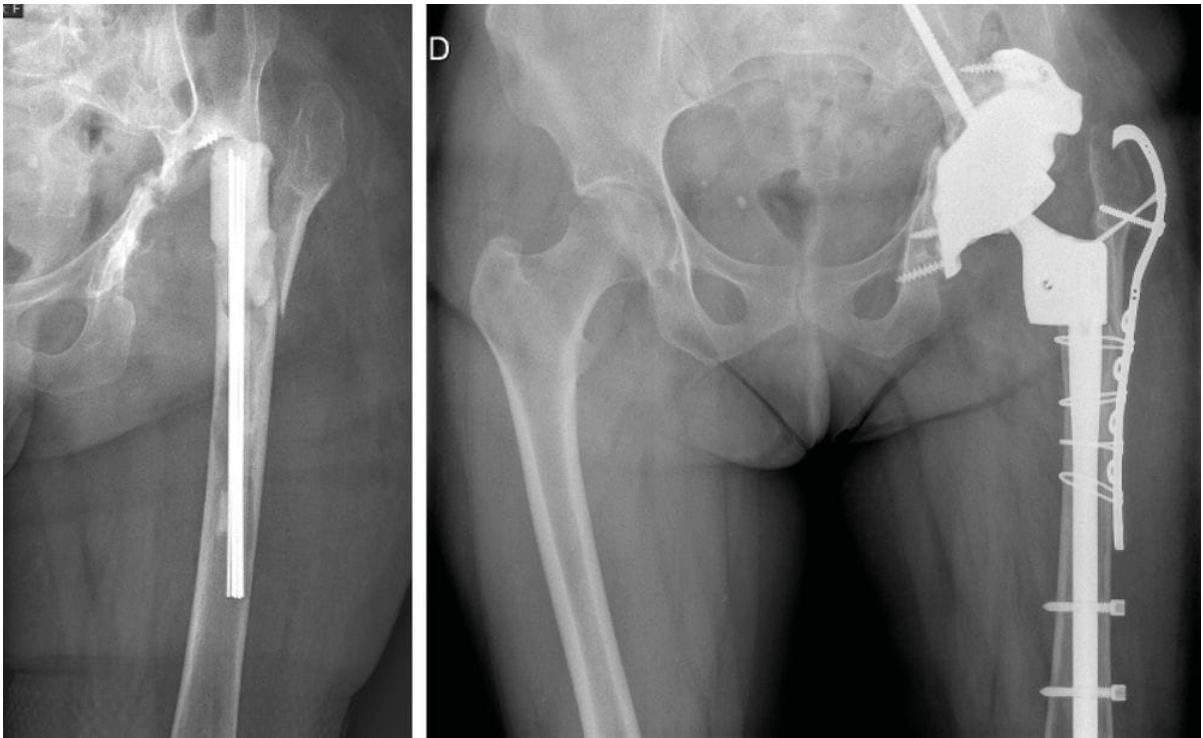


Figure 5: Acetabular loosening 3/4.

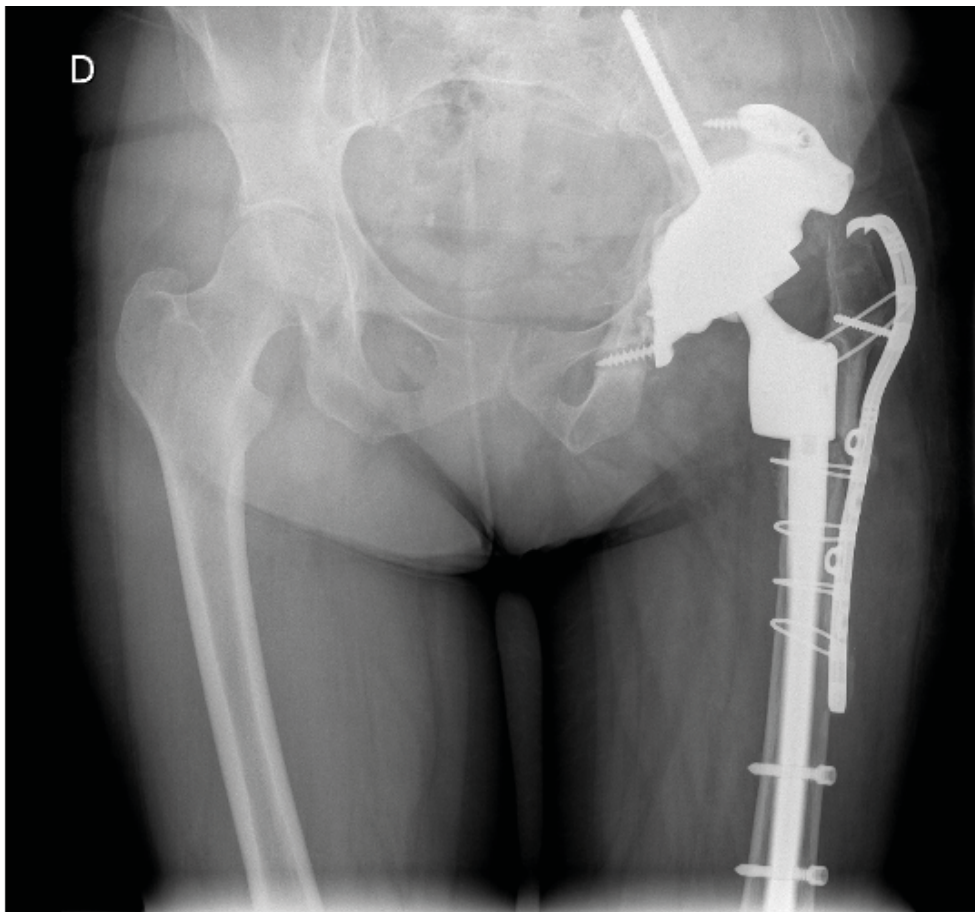


Figure 6: Acetabular loosening 4/4.

3. Infection

There were 66 R1 revisions due to infection (9.9%), and these were compared to the 598 R1 revisions for other causes. In the infection population, patients were younger at revision (70 years; $p = 0.003$), the mean time to revision was 5.3 years ($p < 0.001$) with a median time of 2.5 years, weight and BMI were higher ($p = 0.04$ and $p = 0.024$ respectively), both components were revised in 80% of cases and moving parts in 14% ($p < 0.001$), a trochanteric osteotomy or a bone window were performed in 15% of cases ($p < 0.001$), the femoral component was cemented in 20% of cases ($p = 0.005$), and acetabular reinforcement was rarely used ($p = 0.018$).

R1 revision for infection was associated with a higher failure rate ($p = 0.042$), especially in the first year (18%). There was no difference in terms of complications or deaths.

An analysis of failures in terms of the revision strategy in R1 for infection found that neither revision type, femoral implant, acetabular implant, bearing surfaces nor trochanteric osteotomy had an impact on failure.

Variable	R1 infection Nimes	R1 other causes 598	p-value
Site			
Nimes	33 (50%)	300 (50.2%)	< 0.001
Lyon Sud	6 (9.1%)	216 (36.1%)	
Croix Rousse	27 (40.9%)	82 (13.7%)	
Sex			
Male	33 (50%)	251 (42%)	NS
Female	33 (50%)	347 (58%)	
Age	70 ans \pm 11.5 [34 ; 92]	74 ans \pm 13.7 [14 ; 104]	0.003
Year of index THA	2013 \pm 8 [1984 ; 2021]	2008 \pm 8.9 [1976 ; 2021]	< 0.001
Mean time to revision (years)	5.3 \pm 7.2 [0 ; 31]	10.4 \pm 8.7 [0 ; 41]	< 0.001
BMI (kg/m2)	28 kg/m2 \pm 6.7 [12.4 ; 48.2]	26 kg/m2 \pm 5.2 [15.4 ; 50]	0.024
Type of revision			
Both components	53 (80.3%)	291 (48.7%)	< 0.001
Femur only	2 (3%)	127 (21.2%)	
Acetabulum only	2 (3%)	178 (29.8%)	
Moving parts	9 (13.6%)	2 (0.3%)	
Approach			
Posterior	64 (97%)	590 (98.7%)	NS
Anterior	2 (3%)	6 (1%)	
Lateral	0	2 (0.3%)	
ETO			
Yes	10 (15.2%)	23 (3.9%)	< 0.001
No	56 (84.8%)	575 (96.1%)	
ETO fixation			
Cerclage wire	7 (70%)	14 (60.9%)	NS
Plate	3 (30%)	9 (39.1%)	
Acetabular component			
Standard cup	8 (12.1%)	73 (12.2%)	NS
DM cup	57 (86.4%)	524 (87.6%)	
Constrained cup	1 (1.5%)	1 (0.2%)	
Acetabular component fixation			
Cemented	14 (21.2%)	99 (16.6%)	NS
Cementless	52 (78.8%)	499 (83.4%)	
Acetabular reinforcement			
Kerboull plate or similar	6 (9.1%)	77 (12.9%)	0.018
Burch-Schneider cage	6 (9.1%)	13 (2.1%)	
Augment/custom-made	1 (1.5%)	4 (0.7%)	
No	53 (80.3%)	504 (84.3%)	
Graft			
Allograft	8 (12.2%)	119 (20%)	NS
Autologous graft	3 (4.5%)	48 (8%)	
No	55 (83.3%)	532 (72%)	
Bearing surfaces			
Ceramic-PE	6 (9.1%)	46 (7.7%)	NS
Ceramic-Ceramic	1 (1.5%)	20 (3.3%)	
Metal-PE	59 (89.4%)	532 (89%)	

Femoral component			
Standard stem	33 (50%)	250 (41,8%)	NS
Monoblock long stem	14 (21,2%)	132 (22,1%)	
Long stem modular metaphysis	17 (25,8%)	133 (22,2%)	
Long stem modular neck	2 (3%)	83 (13,9%)	
Femoral component fixation			
Cemented	13 (19,7%)	47 (7,9%)	0.005
Cementless	53 (80,3%)	551 (92,1%)	
Locking femoral component			
Yes	12 (18,2%)	132 (22,1%)	NS
No	54 (81,8%)	466 (77,9%)	
Perioperative complications			
False passage	1 (1,5%)	5 (0,9%)	NS
Fracture	4 (6,1%)	14 (2,3%)	
None	61 (92,4%)	579 (96,8%)	
Complication < 1 year			
Loosening	1 (1,5%)	7 (1,2%)	NS
Fracture	0	10 (1,7%)	
Infection	11 (16,7%)	38 (6,3%)	
Dislocation	1 (1,5%)	18 (3%)	
Other	0	11 (1,8%)	
None	53 (80,3%)	514 (86%)	
Complication > 1 year			
Loosening	0	6 (1%)	NS
Fracture	0	2 (0,3%)	
Infection	3 (4,6%)	9 (1,5%)	
Dislocation	1 (1,5%)	3 (0,5%)	
Other	1 (1,5%)	7 (1,1%)	
None	61 (92,4%)	571 (95,5%)	
Death			
< 1 year	2 (3%)	25 (4,2%)	NS
1-3 years	0	7 (1,2%)	
> 3 years	0	1 (0,2%)	
No	64 (97%)	565 (94,4%)	
Re-revision			
Re-operation	1 (1,5%)	11 (1,8%)	0.042
Re-revision < 1 year	11 (16,7%)	39 (6,5%)	
Re-revision > 1 year	1 (1,5%)	13 (2,2%)	
No	53 (80,3%)	535 (89,5%)	

Table 9: R1 for infection compared to R1 for other causes

Example of revision due to infection

Case report n°6

A 67-year-old female Left THA in 2006, osteonecrosis

- A 2-month history of hip pain
- Report of foot wound 4 months previously complicated by erysipelas treated with oral amoxicillin
- No fever
- WBC 3000, CRP 52
- Bacteraemia MSSA
- Subacute sepsis assumed to be of haematogenous origin
- Course unclear
- Acetabular loosening with implant migration? (Figure 7)

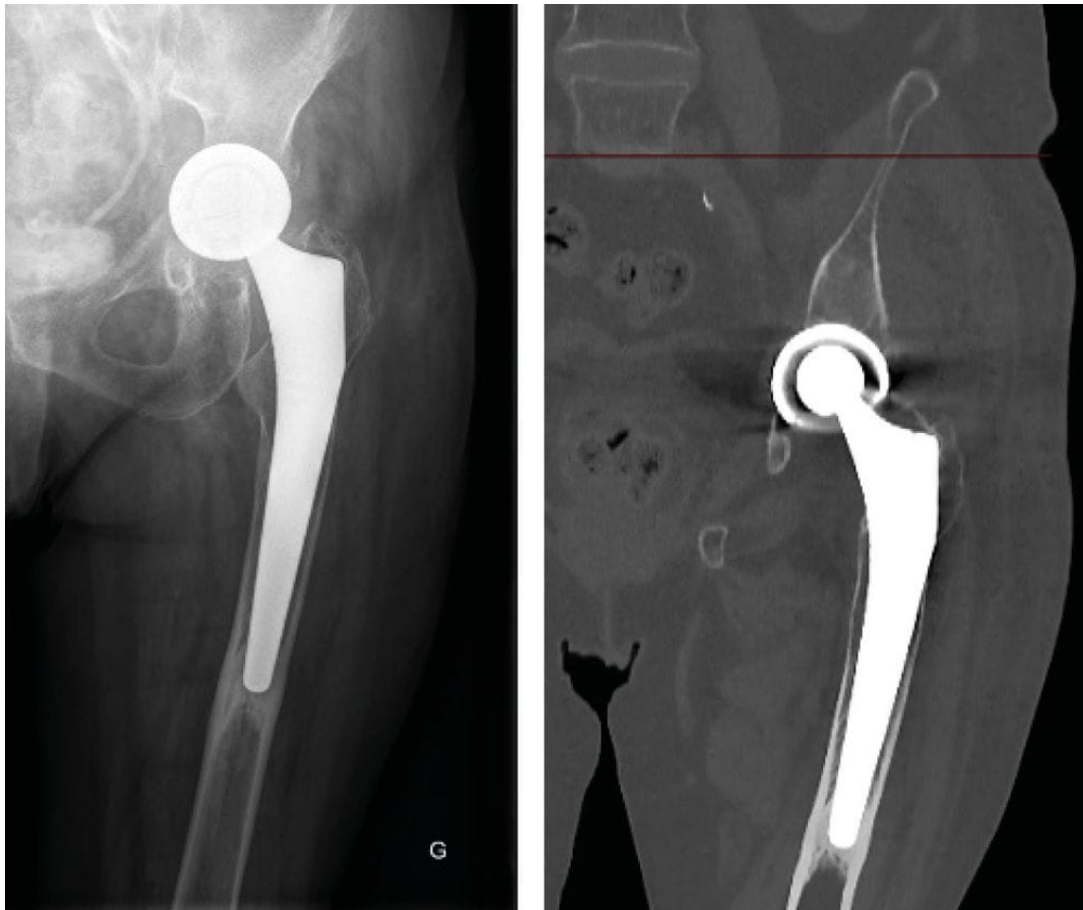


Figure 7: Revision due to infection 1/3

One-stage revision: (Figure 8)

- Acetabular reconstruction with Kerboull cross-plate + bone graft
- Femoral window fixed with cerclage wiring
- Locking long stem and weight-bearing from day 1
- MSSA treated with Ofloset + Rifadin



Figure 8: Revision due to infection 2/3

Recurrence of acute infection after 1 month: (Figure 9)

- Lavage and revision of moving parts
- Negative cultures on ATB
- Treatment with IV Claforan + Daptomycin via PICC line for 3 months
- Follow-up at 18 months OK



Figure 9 : révision pour infection 3/3

4. Dislocation

There were 31 R1 revisions due to dislocation (4.7%), and these were compared to the 633 R1 revisions for other causes. In the dislocation population, patients were younger at revision (65 years; $p < 0.001$), the mean time to revision was 6.1 years ($p = 0.009$) with a median time of 4 years, the acetabulum only was revised in 71% of cases ($p < 0.001$), with no bone graft ($p = 0.008$), and a standard non-locking stem was left in place ($p > 0.001$).

R1 revision due to dislocation was associated with a higher rate of late re-revision (10% as against 1.7%; $p = 0.037$). There was no difference in terms of complications or deaths.

An analysis of failures in terms of the revision strategy in R1 for dislocation found that neither revision type, femoral implant, acetabular implant nor bearing surfaces chosen had an impact on failure.

Variable	R1 dislocation	R1 other causes	p-value
	31	633	
Site			
Nîmes	13 (41,9%)	320 (50,5%)	NS
Lyon Sud	12 (38,7%)	210 (33,2%)	
Croix Rousse	6 (19,4%)	103 (16,3%)	
Sex			
Male	13 (41,9%)	271 (42,8%)	NS
Female	18 (58,1%)	362 (57,2%)	
Age	65 ans ± 12,8 [46 ; 89]	74 ans ± 13,5 [14 ; 104]	< 0.001
Year of index THA	2012 ± 7,1 [1998 ; 2021]	2008 ± 9 [1976 ; 2021]	0.048
Mean time to revision (years)	6,1 ± 7 [0 ; 23]	10,1 ± 8,7 [0 ; 41]	0.009
BMI (kg/m²)	26,4 kg/m ² ± 6,1 [18,1 ; 48,3]	26,2 kg/m ² ± 5,4 [12,4 ; 50]	NS
Type of revision			
Both components	7 (22,6%)	337 (53,2%)	< 0.001
Femur only	2 (6,4%)	127 (20,1%)	
Acetabulum only	22 (71%)	158 (25%)	
Moving parts	0	11 (1,7%)	
Approach			
Posterior	31 (100%)	623 (98,4%)	NS
Anterior	0	8 (1,3%)	
Lateral	0	2 (0,3%)	
ETO			
Yes	0	33 (5,2%)	NS
No	31 (100%)	600 (94,8%)	
Acetabular component			
Standard cup	2 (6,5%)	79 (12,5%)	NS
DM cup	28 (90,3%)	553 (87,4%)	
Constrained cup	1 (3,2%)	1 (0,1%)	
Acetabular component fixation			
Cemented	14 (21,2%)	99 (16,6%)	NS
Cementless	52 (78,8%)	499 (83,4%)	
Acetabular reinforcement			
Kerboull plate or similar	0	83 (13,1%)	NS
Burch-Schneider cage	0	19 (3%)	
Augment/custom-made	0	5 (0,8%)	
No	31 (100%)	526 (83,1%)	
Graft			
Allograft	0	127 (20%)	0.008
Autologous graft	5 (16,1%)	46 (7,3%)	
No	26 (83,9%)	460 (72,7%)	
Bearing surfaces			
Ceramic-PE	1 (3,2%)	51 (8,1%)	NS
Ceramic-Ceramic	0	21 (3,3%)	
Metal-PE	30 (96,8%)	561 (88,6%)	

Femoral component			
Standard stem	28 (90,3%)	255 (40,3%)	< 0.001
Monoblock long stem	2 (6,4%)	144 (22,8%)	
Long stem modular metaphysis	1 (3,2%)	149 (23,5%)	
Long stem modular neck	0	85 (13,4%)	
Femoral component fixation			
Cemented	1 (3,2%)	59 (9,3%)	NS
Cementless	30 (96,8%)	574 (90,7%)	
Locking femoral component			
Yes	0	144 (22,8%)	< 0.001
No	31 (100%)	489 (77,2%)	
Perioperative complications			
False passage	0	6 (1%)	NS
Fracture	0	18 (2,8%)	
None	31 (100%)	609 (96,2%)	
Complication < 1 year			
Loosening	0	8 (1,3%)	NS
Fracture	2 (6,5%)	8 (1,3%)	
Infection	1 (3,2%)	48 (7,6%)	
Dislocation	1 (3,2%)	18 (2,8%)	
Other	0	11 (1,7%)	
None	27 (87,1%)	540 (85,3%)	
Complication > 1 year			
Loosening	1 (3,2%)	5 (0,8%)	NS
Fracture	0	2 (0,3%)	
Infection	1 (3,2%)	11 (1,7%)	
Dislocation	1 (3,2%)	3 (0,5%)	
Other	0	8 (1,3%)	
None	28 (90,4%)	604 (95,4%)	
Death			
< 1 year	0	27 (4,3%)	NS
1-3 years	0	7 (1,1%)	
> 3 years	0	1 (0,1%)	
No	31 (100%)	598 (94,5%)	
Re-revision			
Re-operation	1 (3,2%)	11 (1,7%)	0.037
Re-revision < 1 year	1 (3,2%)	49 (7,7%)	
Re-revision > 1 year	3 (9,7%)	11 (1,7%)	
No	26 (83,9%)	562 (88,9%)	

Table 10: R1 for dislocation compared to R1 for other causes

Example of revision due to dislocation

Case report n° 7

82-year-old female Fractured neck of femur while cross-country skiing

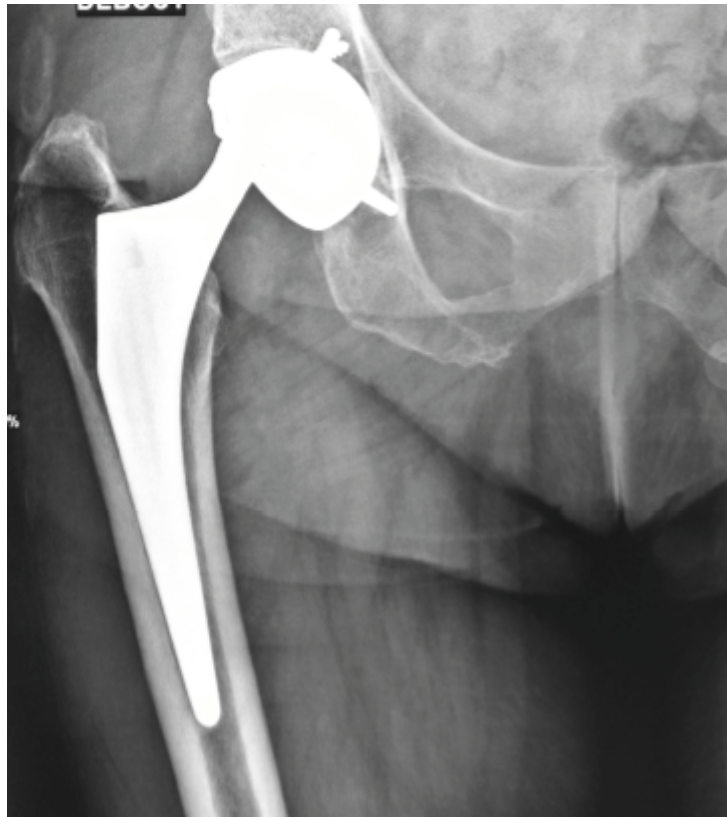


Figure 10: Revision due to recurrent dislocation 1/3

- Hemiarthroplasty
- 3 early dislocations
- Single component revision R1 conversion to dual mobility THA
- 2 further episodes of dislocation reduced under GA
- Feels like hip is clicking ever since last dislocation

Two component revision (R2) (Figures 11 & 12)

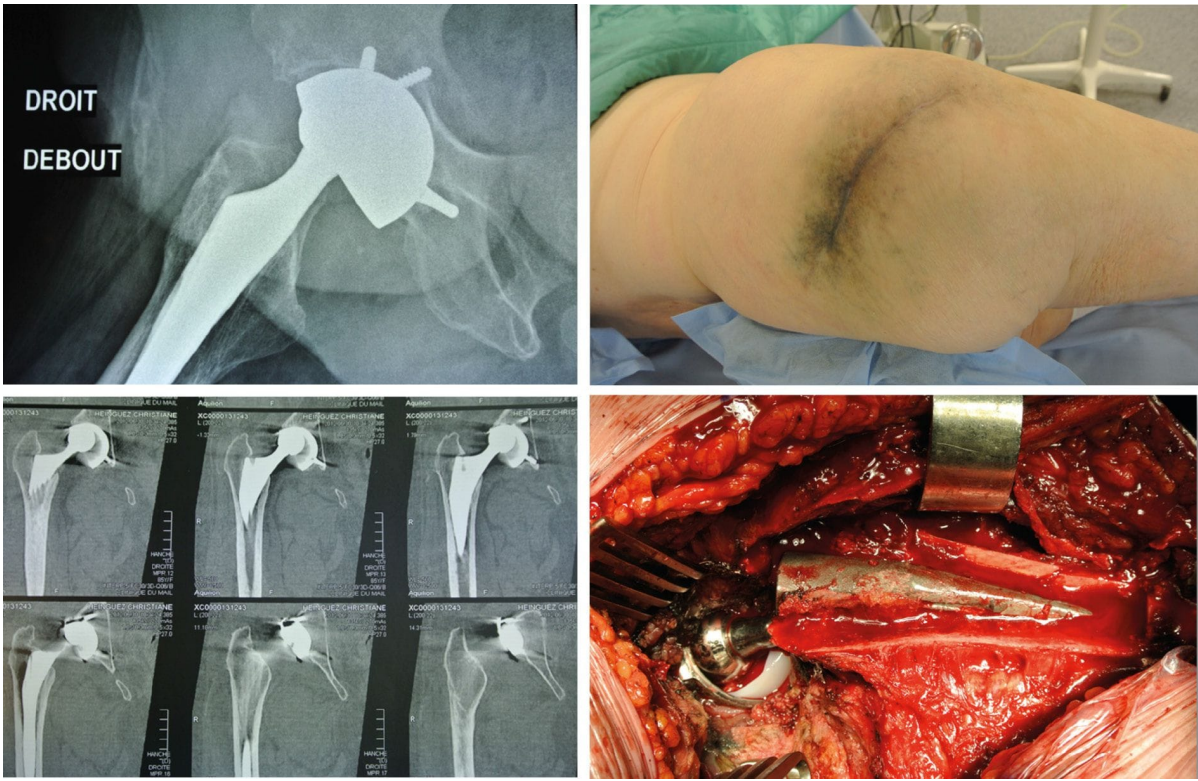


Figure 11: Revision due to recurrent dislocation 2/3 A. Appearance typical of intraprosthetic dislocation B. Scar showing metallic skin tattooing C. Preoperative CT scan showing severe retroversion of the femoral component D. Perioperative view of two component revision



Figure 12: Revision due to recurrent dislocation 3/3

Infection on D15:

- Debridement, moving parts changed, antibiotics
- Radiography after 1 year
- Walking unrestricted with a stick (has stopped cross-country skiing)

DISCUSSION

The analysis of this multicentre cohort of 963 patients who underwent THA revision surgery in France between 2021 and 2015 found a failure rate of 14%. The cause of failure was infection in 53% of cases. The failure mode was early re-revision in 70% of cases. The rate of repeated failure with re-revision in the first year was 20%, and the cause of repeated failure was infection in 58% of cases.

A younger age ($p = 0.019$), revision iteration $> R1$ ($p < 0.001$), the aetiologies of infection and dislocation ($p < 0.001$), choosing a standard or constrained cup over a dual mobility cup ($p < 0.001$), use of an acetabular reinforcement device ($p = 0.011$), and early complications ($p < 0.001$) or late complications ($p < 0.001$) were identified as risk factors for failure.

BMI, type of revision, approach route, trochanteric osteotomy, implant fixation, femoral implant, bone graft, bearing surfaces and perioperative complications were not found to have any impact. Nor was there any link between failure and death.

The subgroup analysis of revision strategy in terms of initial aetiology for revision in the population of 664 R1 primary revisions found that the R1 for fractures subgroup had a higher failure rate with a standard cup than with a dual mobility cup (20.5% as against 8.1%; $p = 0.036$). R1 revision due to periprosthetic fracture was associated with a lower rate of perioperative complications ($p = 0.045$), but a higher death rate than in the other causes (10% as against 1.6% $p < 0.001$), especially during the first year. R1 revision for infection was associated with a higher failure rate ($p = 0.042$), especially in the first year (18%). R1 revision due to dislocation was associated with a higher rate of late re-revision (10% as against 1.7%; $p = 0.037$).

The revision type, femoral implant and bearing surfaces chosen were not found to have any impact on failure, and this applied irrespective of aetiology.

This is the first multicentre study in France to closely examine all-cause THA revision and failure. It presents a case series of 963 revisions, 664 of which were R1 primary revisions, which is representative of the typical workload in French teaching hospitals, with both junior and senior surgeons. The mean age of revision was 71 years and 55% of the population were women, findings that are identical to those seen by teams in Australia [7] and Italy [14]. The main causes for revision were loosening (including wear osteolysis) in 35.6% of cases, followed by periprosthetic fracture in 32%, infection in 15.2% and dislocation in 5.7%.

Loosening was found to be the leading aetiology for revision in the literature, accounting for 53% and 49% of cases in registries from England and Sweden, and 22.3% in a literature review of 9,952 cases [15]. In the USA, dislocation has long been the leading aetiology for revision accounting for 22.5% of 51,345 revisions according to Bozic et al. [16], which could potentially be attributed to the fact that the dual mobility cup was only approved by the FDA in 2009. A few years later, Badarudeen et al. [17] again found that loosening was the main aetiology for revision at 40.7% of 3,555 cases. They also found a repeated failure rate of 15.8%, close to the results in our case series, with the leading causes of re-revision being infection and dislocation.

Infection ranked as the main aetiology for revision in Australia at 22.7%, the second in Sweden at 21.5% and in Italy at 10.5% [14], the third in France at 15.2% and in the USA at 11.3% [16],[17]. In our case series it was the leading cause for re-revision, although the sites may have had an effect since Nîmes and Lyon Croix Rousse Hospitals are referral centres for complex bone and joint infections (CRIOAC). Jafari et al. [18] also found infection to be the leading cause of revision failure. More recently, Schwartz et al. reported a 65% increase in the number of revisions due to infection over the past 10 years [12]. A study of the Nordic registry, however, found that the rate of revision due to infection had doubled in the past 15 years [19], occurring mainly in the first 3 months after surgery, findings that are backed up by the English registry [20]. More generally, Brochin et Kurtz reported an increase in the rate of implant infections [21],[22], possibly due to an improved understanding of the pathophysiology and more routine investigation looking for less aggressive bacteria such as staphylococcus epidermidis and cutibacterium acnes, as infection with these has probably been previously underestimated [19]. In this respect, Renard et al. reported an occult infection rate of 7% in cases of revision that had been thought to be aseptic [23].

With the rise of the X3 polyethylene insert, the use of femoral heads 36mm or larger and the very widespread use of dual mobility cups (88%), dislocation has today fallen to the fourth cause of revision in France (5.7%). This is borne out in our case series, in which we found the dual mobility cup to have a protective effect against failure overall ($p < 0.001$) and against failure in primary revision due to periprosthetic fracture ($p = 0.036$). The recent literature, including from the USA, is in agreement that using a dual mobility cup in revision drastically reduces the rate of dislocation after revision [24],[25] without increasing the risks of loosening due to wear of the PE insert [26] or of infection [27]. There is one complication specific to dual mobility cups, intraprosthetic dislocation, which De Martino et al. looked at in a recent literature review of 5,064 revisions, and found that the rate of intraprosthetic dislocation was 1.3% compared to an overall dislocation rate of 3% [28]. In our case series of 963 revisions, there were two cases of intraprosthetic dislocation (0.2%) out of an overall dislocation rate of 2.5%. In both of these cases a Stryker Modular Dual Mobility system was used (MDM®X3®).

In cases of revision due to dislocation, however, the failure rate was 29%, 43.7% of which were caused by recurrent dislocation, which almost exclusively affected repeated revisions due to chronic instability, and this was the case in spite of the use of a dual mobility cup. These results are consistent with those seen in the literature, which report a recurrent dislocation rate of 21–39% in cases of revision due to dislocation [29], with the risk factors for failure being a history of chronic instability and a higher number of hip surgeries on the affected hip, leading to hip abductor deficiency [30]. While use of a constrained cup protects against dislocation, it was associated with a higher failure rate in our case series (60%; $p < 0.001$), with the leading causes being infection and loosening. Here, there is likely to be bias introduced in the analysis, due to the fact that use of a constrained cup or acetabular reinforcement device is dictated by preoperative conditions that are already complex, such as repeated revisions or bone loss, and it is expected that the results will not be as good as those of an uncomplicated revision.

Finally, periprosthetic fracture seems to be less common in the international literature. Yet it is the second cause of revision in our case series at 32%, the third in Australia at 21.8% and the fourth in Sweden at 9.2%. A previous multicentre study in France [31] from 2010 had already found fracture to be the second cause of revision (11.8%), which suggests that there has been a significant increase in the number of revisions due to fractures in the past 10 years.

This study does have limitations. It was a retrospective case series, with the data depending on the accuracy of coding in the PMSI database. Post-operative follow-up beyond one year was not ideal in this population of elderly subjects who have undergone multiple operations, and there was a certain amount of missing data. For example, there are likely to be errors in the data on mortality because of a lack of exhaustive follow-up beyond one year. There was no analysis of the clinical data, such as functional scores, resuming activities, length of stay,

comorbidities and their impact on failure, or whether discharges were to home or an institution. The aetiology of the index THA index was also not known.

CONCLUSION

Revision surgery is going to increase significantly over the coming years due to the expansion of primary surgery and the ageing population. It involves different technical challenges specific to each aetiology, in terms of bone loss, stability after revision and an increased risk of infection. Infection is today the leading cause of failure in first revisions in France, both in the guise of “new infections” and repeated failure of revisions due to infection. Cases of complex recurrent instability must drive us to improve our understanding of the relationships of hip–spine dynamics and to rigorously analyse implant positioning. We recommend using a dual mobility cup in revision surgery, including for periprosthetic fracture.

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