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## Revision and complication rates in 654 Exeter total hip replacements, with a maximum follow-up of 20 years

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### Abstract

**Background:** Iceland's geographical isolation with a stable and small population gives a rare opportunity for follow-up studies of medical interventions. Total hip replacements (THR) have been done at FSA Central Hospital in Akureyri, Iceland since 1982 with the Exeter hip implant being in use from the beginning.

**Methods:** Hospital records for all patients operated on with THR between 1982 and the end of 1999 were reviewed and the patients were followed until the end of 2001. Information was gathered regarding the indication for primary surgery, the reason for revision if needed, as well as that of any complications. Survival statistics were used to calculate the cumulative revision rate.

**Results:** The mean age at primary THR was 68.4 years for males and 68.8 years for females. 654 primary THRs were done; of which 571 (87 %) were due to osteoarthritis. 37 of the primary arthroplasties had been revised before the end of year 2001.

**Conclusion:** We have in this unique 2–20 year study of 654 THRs with no loss to follow-up for the patients, found revision rates that conform with the large Swedish THR registry. Complication rates in general are in agreement with that reported for other comparable patient groups, while infection rates appear lower.

### Background

Total hip replacements (THR) were introduced in Iceland in 1967 and operations begun at FSA Central Hospital Akureyri in 1982 when the orthopedic department opened. The cemented Exeter prosthesis was used from the beginning. FSA Central Hospital is the second largest hospital in Iceland, and although it primarily serves a local population of forty thousand, patients from the whole of Iceland are able to seek service there. About 15 % of the

THRs operated at FSA hospital come from outside the Akureyri service area.

In Iceland, as in other Scandinavian countries, all persons have a unique personal identification number. This, combined with a highly computerized national health system, makes it possible to identify all patients operated on for a given diagnosis or by a certain procedure in Iceland [1]. The National Census and death register makes it possible to locate all Icelanders, that is where they live and if they

are alive. With a total Icelandic population of only 280 000 and a close contact between colleagues it is possible to follow all those who have undergone a THR in Iceland. The primary purpose of this study was to compare the revision rate of Exeter THR's inserted at the FSA with that of other hospitals found in the literature, and furthermore to assess the complication rate by the use of a detailed complication register in a study cohort without loss to follow-up for the patients.

## Methods

Through a computer-aided search of hospital records, we obtained information on all patients who had undergone THR at Akureyri hospital between the years 1982 and 2000. All medical records were checked to confirm the diagnosis, search for complications and gather the reasons for any revisions performed. Since 1992 this information has been registered prospectively. The personal identification number was used to check if a patient had sought service in other orthopedic departments in Iceland or moved abroad, which none had, after the primary procedure had been performed. Surgical technique and prophylactic measures against thrombosis and infection at Akureyri Hospital have been quite constant throughout the eighteen-year period studied here. Prophylactic antibiotics and compression stockings were thus used in all cases. Low molecular weight heparin replaced dextran as anti-thrombotic treatment in 1992. The same five experienced surgeons did 99 % of the operations. All patients were operated on with a posterolateral incision and a posterior arthrotomy, without the use of trochanteric osteotomy. The same type of cement (Palacos® with gentamicin) was used during the whole period. Vacuum mixing was introduced in 1987. All operations were done in an operating theatre that is solely for clean orthopedic operations, but without laminar flow or space suits. 95% of the patients were operated in spinal and/or epidural anaesthesia. In the beginning a matte stem was in use, which was replaced by the polished stem during 1987–1989. All poly cup was used, except for the years 1986–1990, when a metal backed cup was used. Revision was defined as exchange of one or both prosthetic components or removal of the implant. Complications encountered during the primary hospital stay were registered at discharge. If a patient was re-admitted to the hospital due to a complication, this was registered separately. Bacterial cultures were taken from wounds with clinically suspected infection and those with positive culture of pathogenic bacteria and requiring antibiotic treatment were registered as wound infection. The diagnosis of pulmonary embolism was made by clinical symptoms and standard chest x-rays. No patients were excluded from the study and all patients were followed until 31<sup>st</sup> of December 2001, when the study ended.

## Statistics

The cumulative revision rate (CRR) was calculated with Kaplan-Meier statistics (SPSS-software ver. 11). SPSS tables were exported to Excel in which graphs were plotted with the corrected confidence intervals, calculated by the Wilson quadratic equation with Greenwood and Peto effective sample size estimates[2] (the scripts used were those used by the Swedish Knee Register).

Curves were cut-off when 40 hips remained at risk. Cox's regression was used to compare time periods adjusting for gender and age.

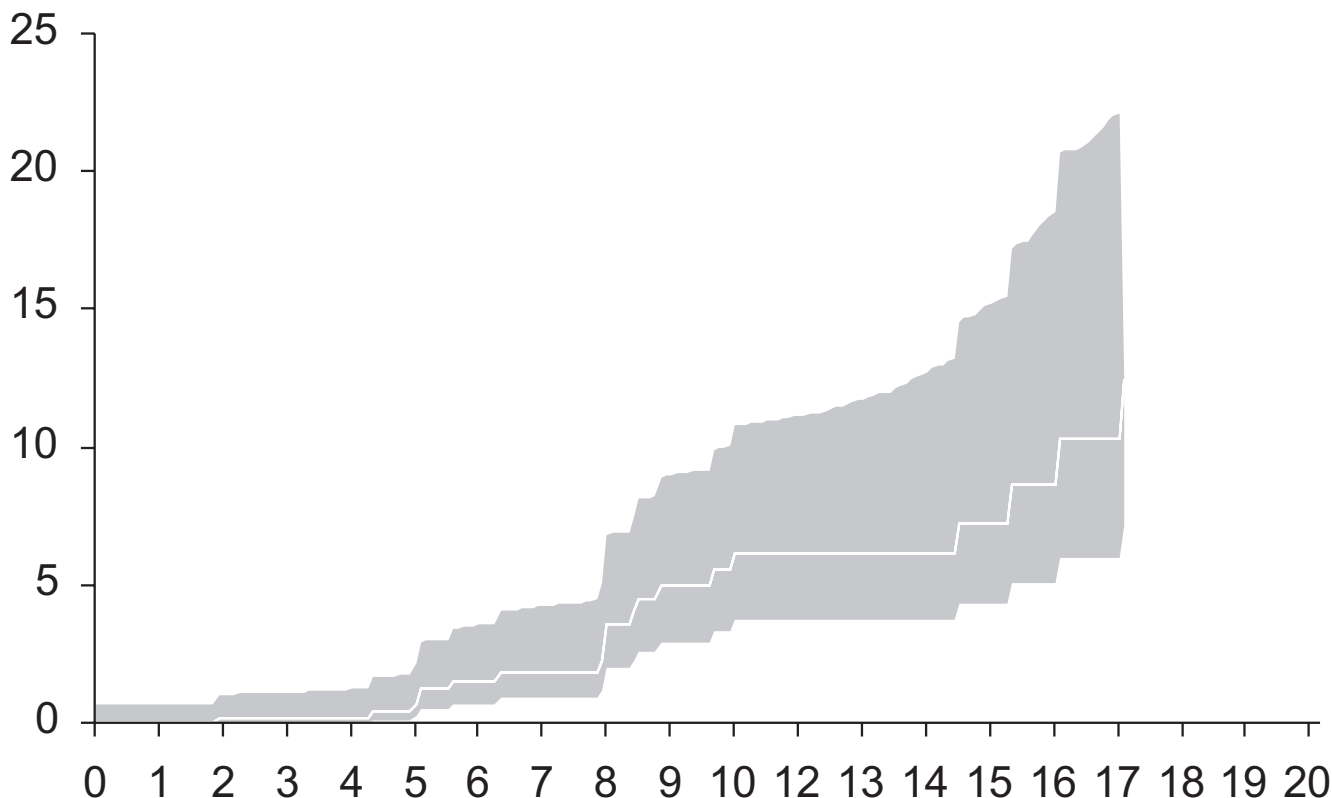
## Results

### Survival

Between November 1982 and January 2000 654 primary hip replacements in 548 patients were done using the Exeter prosthesis. The preoperative diagnosis in primary THR was osteoarthritis (571 hips, 87 %), rheumatoid arthritis and other forms of arthritis (17 hips, 3 %), hip fractures and complications of hip fractures (42 hips, 6 %) and other reasons (24 hips, 4 %). The mean age for men undergoing primary THR for osteoarthritis was 68.4 years and for females 68.8 years. The average hospital stay decreased from 22 days in the beginning of the study to 11 days in 1999. At the end of the study 158 of the 591 patients had died.

At the end of the follow-up period 37 of the 654 primary arthroplasties had undergone revision. This included three implants primarily inserted at FSA Hospital but revised at other hospitals. The reasons for revisions were aseptic loosening (28 cases, 4.3 %, including 2 stem fractures (older matte stem) at 7 years and 10 years postoperatively), recurrent dislocations (7 cases, 1.1 %) and infection (2 cases, 0.3 %) (Table 1). One female patient had revisions on both hips due to recurrent dislocations and one male had both hips revised because of aseptic loosening.

Survival statistics for primary THR for OA using aseptic loosening as an endpoint show that for the whole period the revision rate after 10 years is 6 % and after 16 years 10 % (Fig. 1). For primary OA using all revisions as an endpoint the respective numbers are 8% at 10 years and 13% at 16 years (Fig. 2). After 1990 only the polished Exeter stem and all-poly cup was used and after 1990 modern cementing techniques were implemented. The 10 year survival for primary OA hips were 4% using aseptic loosening as an endpoint and 7% using all revisions as an endpoint. Cox regression comparing the 2 time periods (1982–1990 and 1991–2000) adjusting for gender and age showed no significant difference in risk of revision. The gender did not significantly affect the risk while the risk decreased with increasing age.



**Figure 1**  
**Cumulative revision rate for the period between 1982 and 2000.** Cumulative revision rate due to aseptically loosening of primary THR due to OA for the period between 1982 and 2000. The shadowed area indicates the 95 % confidence interval. Curves were cut off when 40 patients remained for analysis.

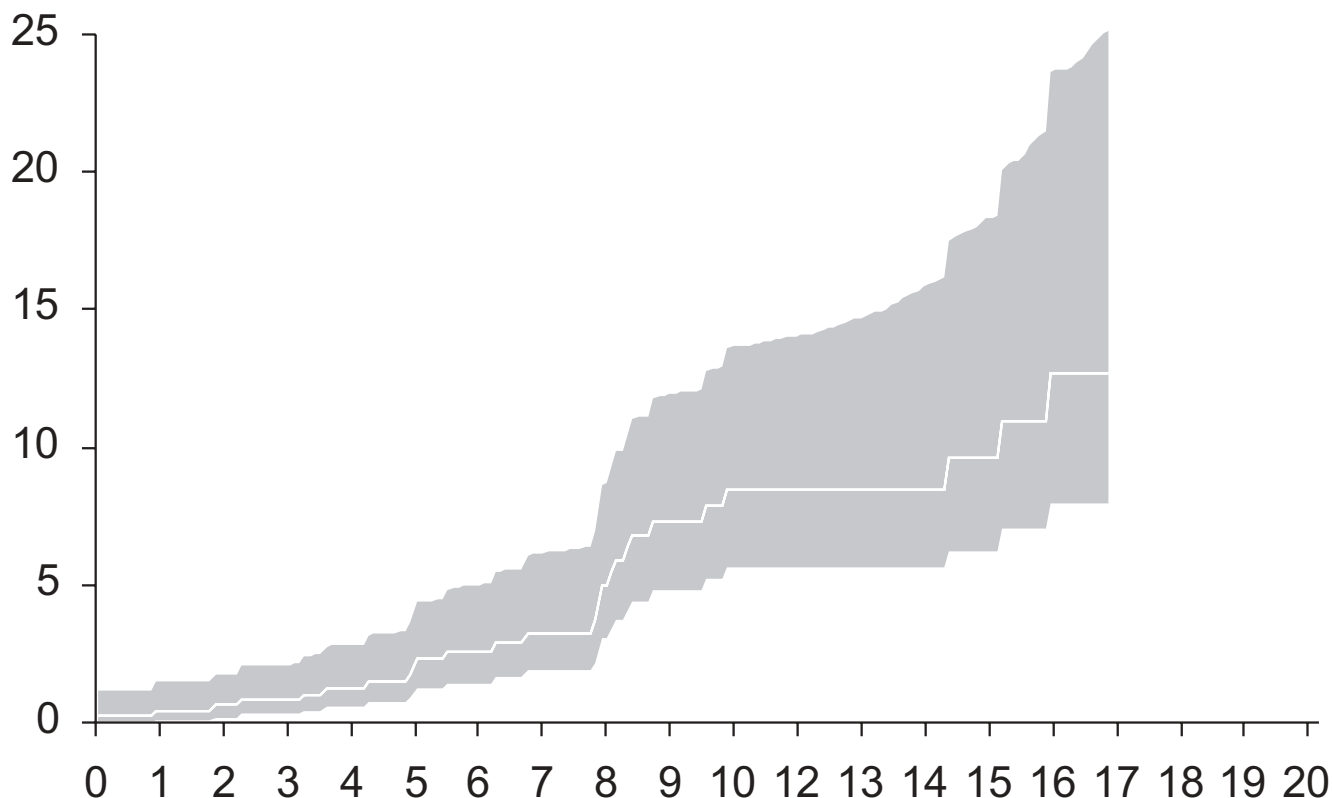
**Table 1: Reasons for revision of primary arthroplasties**

|                        | Cases | M/F ratio (Cases) | Total revision | Cup revision | Femur revision |
|------------------------|-------|-------------------|----------------|--------------|----------------|
| All reasons            | 37    | 12/25             | 13             | 17           | 7              |
| Aseptic loosening      | 26    | 8/18              | 10             | 13           | 3              |
| Stem fracture          | 2     | 1/1               | 1              | 0            | 1              |
| Recurrent dislocations | 7     | 1/6               | 0              | 4            | 3              |
| Infection              | 2     | 2/0               | 2              | 0            | 0              |

**Complications**

All complications that occurred during the hospital stay were registered (Table 2). There were 10 cases of pulmonary embolism, out of which two occurred after discharge. All were non-fatal. It is worth mentioning that after the introduction of low molecular heparin prophylaxis in 1992 only two cases of deep venous thrombosis (DVT) or pulmonary embolism have been diagnosed. In the 7 cases of

nerve injury the recovery varied from partial to complete. The 20 cardiac and cerebrovascular incidents included atrial fibrillation, myocardial infarction, heart failure and cerebrovascular infarction, none of which were fatal. Two wound infections were caused by *S. aureus* and after treatment with antibiotics the patients had no sequelae. Only 4 cases of urinary tract infection were diagnosed, this may be due to the prophylactic use of ampicillin for all patients



**Figure 2**  
**Cumulative revision rate for the period between 1982 and 2000.** Cumulative revision rate due to any cause of primary THR due to OA for operations done between 1982 and 2000. The shadowed area indicates the 95 % confidence interval. Curves were cut off when 40 patients remained for analysis.

**Table 2: Complications of primary THR encountered until hospital discharge or requiring re-admission.**

|                                     | Cases | %     |
|-------------------------------------|-------|-------|
| DVT and/or PE*                      | 10    | 1.5%  |
| Wound infection                     | 3     | 0.5%  |
| Wound rupture                       | 2     | 0.3%  |
| Nerve injury                        | 7     | 1.1%  |
| Dislocations                        | 33    | 5.0%  |
| Intraoperative fracture             | 1     | 0.2%  |
| Cardiac or cerebrovascular incident | 20    | 3.1%  |
| Urinary tract infections            | 4     | 0.6%  |
| Death                               | 1     | 0.2%  |
| Other                               | 24    | 3.7%  |
| Total                               | 109   | 16.6% |

\* DVT = deep venous thrombosis, PE = pulmonary embolism.

who got a urinary catheter. One patient died from complications of diverticulitis of the colon with septicaemia, which resulted in a wound infection with mixed culture.

The cause of death was intraabdominal infection. Complications listed as other were mainly adverse drug reactions and gastrointestinal problems.

## Discussion

The Exeter hip prosthesis was developed and introduced in Exeter, England in 1970 and was intended for use through the posterior approach, allowing accurate insertion and requiring minimal operative assistance. In 1976 the surface finish of the stem was changed from polished to matte, which was followed by an increase in aseptic loosening. The polished stem was thus re-introduced in 1986, which resulted in a decrease in stem loosening [3]. Metal backing of the cup was introduced in 1986, largely based on theoretical grounds and again led to an increase in aseptic loosening of the cup [4]. An all-plastic cup replaced it in 1990 [5].

The demographics of the study group are similar to reports from other Scandinavian countries, although primary osteoarthritis was a more common reason for THR (87 % vs. 70–80 % in the other Scandinavian countries [3,6–8]). This is consistent with osteoarthritis being more common in Iceland than in e.g. Sweden [9].

## Conclusions

We present the results of 654 primary THR's performed from 1982 until 2000. Our results are comparable with those presented in other Scandinavian hip registers. We also present what we believe to be a complete register of all complications incurred during or after the operations. Perhaps the most unique aspect and major strength of this study is that no patient was lost to follow-up or excluded from analysis. It is commonly assumed in survival analysis and complication reports that patients lost to follow-up would have had the same outcome as those not lost to follow-up. However, recent studies have shown that those lost to follow-up have poorer results than the rest, underlining the importance of low rate of loss to follow-up [10].

The incidence of nerve injury, dislocation and pulmonary embolism was comparable to recently published results [11], while the incidence of wound infection was lower [12]. Both matte and polished femoral components were used and acetabular cups were pure polyethylene or with metal backing. Similar to the Swedish THR registry we note an improvement in the results during the last decade with the implementation of modern cementing techniques and better implants.

## Competing interests

None declared.

## Authors' contributions

JF collected the data and was responsible for data analysis and drafting the manuscript. OR performed the statistical analysis. JG and TI conceived the study and collected data. TI, OR and SL revised the manuscript.

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