

Increased risk for early periprosthetic fractures after uncemented total hip replacement

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ABSTRACT

INTRODUCTION: The purpose of this study was to describe a new type of proximal periprosthetic fracture occurring within the first six weeks after total hip arthroplasty and to analyse possible causes of a rising incidence.

MATERIAL AND METHODS: Patient files and radiographs from 2,408 uncemented hip replacements were analysed and patients with a periprosthetic split fracture reaching from the calcar to the medial femoral shaft below the lesser trochanter were included.

RESULTS: A total of 28 fractures in 2,408 uncemented primary hip replacements were included. Almost all fractures were seen in women. No correlation with diagnosis, age, body mass index, operation time, operative technique or implant position could be demonstrated, but a possible correlation with post-operative mobilisation and pain treatment was observed. Trainees had more fractures than experienced surgeons (non-significant).

CONCLUSION: We conclude that the increasing use of uncemented hip replacements implies an increasing risk of perioperative femoral fracture. The cause of the fractures remains unclear, but is probably multifactorial.

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Periprosthetic femoral fracture can occur intraoperatively or later with or without concomitant loosening of the femoral component. Most publications deal with late periprosthetic fractures and the treatment of these, often difficult, cases.

The periprosthetic fractures are usually classified according to the Vancouver classification as described by Brady et al [1]. Intraoperative fractures are classified as Type A (fracture of either the greater or lesser trochanter), and subsequently excluded from further analysis in the published papers [2]. The usual way to handle these type A fractures is either conservative treatment with restricted weight bearing or intraoperative fixation.

Late occurring periprosthetic fractures of type B and C are demanding and often require exchange of a loose femoral implant. Since 2000, the incidence of periprosthetic fractures has been rising in Sweden [3].

In the Hip Clinic in Hørsholm Hospital, Denmark, the number of early post-operative periprosthetic fractures has been growing as from 2006. The fractures could not

be classified according to the Vancouver classification as either simple fractures of the greater or lesser trochanter, but are (SS) femoral split fractures reaching from the calcar to the medial femoral shaft 8-10 cm below the lesser trochanter. No trauma had been registered in any of these cases.

The purpose of the present study was to describe the occurrence of this fracture type and to analyse possible reasons for the rising number of fractures recorded.

MATERIALS AND METHODS

Since 2000, all total hip arthroplasty (THA) patients operated in the Hip Clinic in Hørsholm Hospital have been subjected to a comprehensive quality control 6-12 weeks post-operatively. This control included audit of the patient files and analysis of the radiographs. A total of 3,295 primary THAs were performed during the nine-year period 2000-2008.

A total of 2,408 of the patients were operated with an uncemented prosthesis (The Bimetric femoral component (Biomet) and the Trilogy acetabular cup (Zimmer)). The femoral head was 28, 32 or 36 mm CrCo or ceramic heads. All patients were operated using the posterolateral approach.

The quality audit included age, sex, surgeon, implant used, operation time, blood loss, admission time, pain management and a registration of possible post-operative complications (haematoma, dislocation, intra- and post-operative fracture). The radiographic position of the implant (degrees of varus or valgus) was measured, but no attempt was made to classify the shape of the proximal femur (fluted or pipe-shaped).

Fractures occurring during the first six post-operative weeks were registered and classified as intraoperative (usually Vancouver type A) or post-operative split fractures.

Statistical analysis was performed calculating and comparing confidence limits. The level of significance used was 0.05.

Trial registration: not relevant.

RESULTS

A total of 85 fractures were seen in the 3,295 patients

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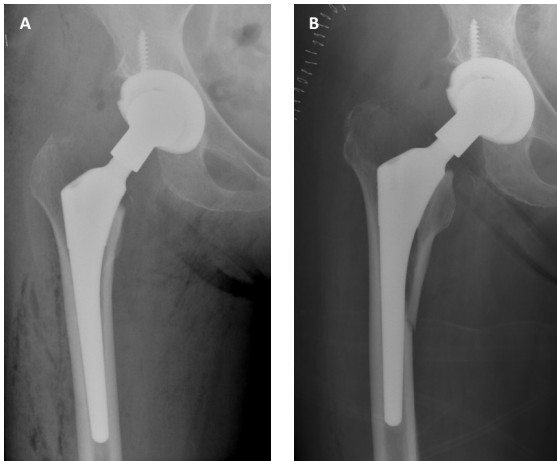

FIGURE 1

Intraoperative crack (Vancouver type A) treated by cerclage wire.



FIGURE 2

A. Post-operative radiograph on day three – no fracture seen. B. Radiograph on day four with a split fracture from the calcar and subsidence of the implant. No trauma had occurred.



(2.6%). A total of 2,408 of the patients had an uncemented femoral component with a fracture rate of 2.9% (69 patients). Forty-one of the 69 fractures in uncemented THAs were intraoperative cracks (Vancouver type A) which were usually treated with cerclage wires during the index operation (Figure 1). In 28 of the 2,408 uncemented cases (1.2%), a “new” type of fracture was seen. Immediate post-operative radiographs on the sec-

ond or third day were normal, but seven (median) and 14 days (average) post-operatively, a sudden pain in the thigh without any trauma was experienced. Radiographs now showed a slightly displaced split fracture from the calcar region to the medial femoral shaft 8-10 cm below the lesser trochanter (Figure 2) with subsidence of the implant. Re-operation with exchange of the implant after internal fixation of the fracture with cables or a trochanteric grip was usually performed.

The 28 cases of split fracture were further analysed. No statistical correlation could be found with the patient's body mass index (BMI) (average BMI 25 kg/m²), age (average 67 years, range 56-84 years) or operation time (average 62 minutes). No correlation could be found with the technique (use of box chisel), head size (28 mm in 19 patients, 32 mm in eight patients, 36 mm in one patient) or the diagnosis, e.g. previous femoral neck fracture.

Patients with split fracture had an average position of the femoral component of 0.32° varus compared with the total number of 2,408 patients with 0.25° of varus (non-significant).

The number of split fractures increased during the period from 0.4% in 2000 to 2.2% in 2008 (non-significant). In the same period, the use of uncemented femoral components increased from 40% to 99% (Figure 3).

Most patients had been operated by experienced surgeons. In these cases, the fracture rate was between 0.4% and 2.2% (non-significant), but in 67 cases the operation was performed by trainees assisted by an experienced surgeon. The fracture rate in these cases was 6%. This difference, however, was not significant. Thus, the surgeon's experience had no significant influence on the fracture rate. A further analysis showed that 27 of the 28 split fractures were seen in women, but no correlation with previous femoral neck fracture could be demonstrated.

The steep increase in fracture rate occurred in 2006. In August 2006, the post-operative regime was changed to fast-track mobilisation with immediate weight bearing, efficient pain treatment with local instillation of bupivacaine, non-steroidal anti-inflammatory drugs (NSAID) and epinephrine, and a reduction of the length of stay from five to four days. A total of 20 of the 28 fractures were seen after this date.

The femoral component used was the uncemented Bimetric stem, in most cases with hydroxyapatite. From May 2007, new instruments were used and the number of available sizes of the implant increased from implants with a 2 mm increment to a 1 mm increment.

No further changes of the prosthetic concept were made in the period of registration. The analysis of the material could not further clarify the exact reason for the increase in fracture rate.

DISCUSSION

It is well known that there has been an increase in the number of periprosthetic fractures over the past decade. This has been attributed to several factors such as a growing number of patients with arthroplasties in the community and more frequent use of uncemented femoral stems [2].

In this material, we describe a new, previously unreported type of post-operative fracture seen after uncemented hip arthroplasty. This fracture is characterised by its appearance as a split fracture that involves the medial part of the calcar region reaching distally through the medial cortex 8-10 cm below the lesser trochanter. No relevant trauma is associated with the fracture, which occurs within the first few (1-6) weeks after the index operation. The fracture type presented here has not been seen in any of our cemented femoral components. So there seems to be a difference in the fracture pattern between cemented and uncemented prostheses.

The classification most often used to characterise periprosthetic fractures of the femur is the Vancouver classification. The fracture in question could be described as an early Vancouver Type B or a late type A2 fracture.

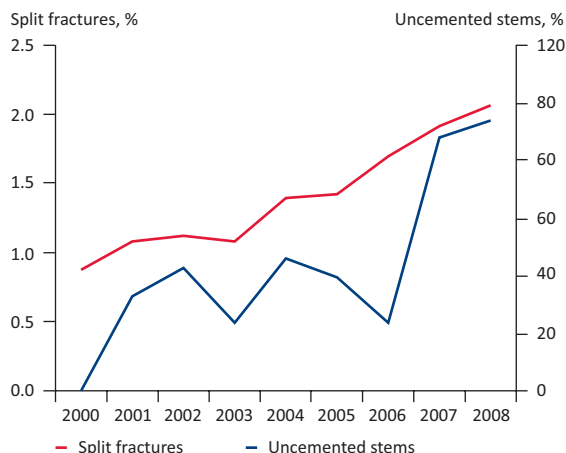
The present material includes 28 fractures of the above described fracture type. We included only early fractures diagnosed within the first six weeks after surgery, and we agree with Cook et al [4] that these fractures can be regarded as a complication related to the initial surgery. Most operations were performed by experienced surgeons using the same surgical technique, The Bimetric system, which is provided with a cutting guide assuring the angle of the cut. The perpendicular cut sometimes necessary to finalise the preparation of the calcar is performed at the utmost lateral part of the neck in close proximity to the greater trochanter. The described fracture arises 1-2 cm more medially. Thus, we do not find that this cut is responsible for the fracture.

The material was analysed in order to establish a causal connection to one or more possible factors. It was evident that most fractures occurred in the last six months of 2006 or later. This coincided with a decrease of the post-operative length of stay in the hospital from five to four days, which was made possible by the use of more efficient treatment of post-operative pain, thus enabling a more vigorous mobilisation of the patient. An increased fracture rate, though, has not been demonstrated in papers on fast-track surgery [5].

Furthermore, it was evident that this fracture occurred almost exclusively in female patients. Patients with osteoarthritis are not routinely screened for osteoporosis; but if a previous fracture of the hip can be seen

FIGURE 3

Incidence of femoral split fracture and percentage of uncemented femoral component over the period.



as a sign of osteoporosis, no correlation to osteoporosis could be found.

We found no correlation between age and early post-operative fracture ($p > 0.05$). Nor did we find any correlation between BMI, operation time, position of the prosthesis or head size and fracture rate. Sarvalinna et al [6] found a 4.4 times increased risk for periprosthetic fracture if the primary diagnosis was a femoral neck fracture. The observation time was up to 15 years; in our material, only fractures occurring within the first six post-operative weeks were included.

Although not statistically significant, there was a tendency towards more fractures for surgery performed by a trainee. The reason for this remains unexplained.

Because of the chisel-type form of the fracture, it may be suspected that the type and design of the femoral component used could be of importance for the occurrence of the fracture. In this material, a hydroxyapatite-coated Bimetric stem was used. It is our experience that this stem can be very difficult to seat correctly in the femur despite meticulous reaming. Furthermore, the prosthesis has a rather bulky proximal part stressing the femur in the calcar region. In this material, we did not have the opportunity to compare different designs of femur stems or rasps.

CONCLUSION

An increased rate of proximal femoral fractures has been demonstrated during the past five years. A new type of fracture has been registered during this period. The fracture occurs without any trauma and usually within the first six weeks post-operatively. The cause of the fracture remains unclear, but is probably multifac-

torial: female sex, early mobilisation and weight bearing, inexperienced surgeon and perhaps prosthetic design may play a role.

The increased use of uncemented femoral components implies an increased number of post-operative fractures, and thus a higher revision burden due to femoral fracture. Results from hip registers [7] demonstrate a better survival of uncemented total hip replacements as far as aseptic loosening is concerned, but early revisions due to fracture seem to increase. It is therefore mandatory to minimise this complication.

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CONFLICTS OF INTEREST: Disclosure forms provided by the authors are available with the full text of this article at www.danmedj.dk.

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