



Direct anterior total hip arthroplasty : complications and early outcome in a series of 300 cases

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The direct anterior approach for total hip arthroplasty has gained popularity throughout the last decade. Early reports showed successful results with rapid functional recovery and low dislocation rates. However there is some concern about the high number of complications induced by the technique.

The aim of this study was to examine the early radiological outcome and perioperative complications in a consecutive series of 300 total hip arthroplasties performed through a minimal invasive anterior approach with the aid of a positioning table.

We observed 9 (3%) intra-operative complications : two femoral perforations, 4 calcar fractures and 3 greater trochanter fractures. There were 42 (14%) postoperative complications and 20 (6.7%) patients required a surgical re-intervention. Our major finding was early peri-prosthetic femoral fracture in 5 patients, not noticed during surgery. The dislocation ratio (2 cases, 0.66%) was low.

The complication ratio decreased throughout our series, but statistical significance could not be shown ($p = 0.26$).

Surgeons should be aware of the high risk of occult intra-operative fractures when starting with this technique.

Keywords : total hip arthroplasty ; anterior approach ; minimal invasive ; complications.

INTRODUCTION

Minimally invasive total hip arthroplasty has drawn a lot of attention over the past years and generated some controversy. The potential advantages of minimally invasive surgical approaches include reduced blood loss, less soft-tissue damage, reduced pain, shorter hospital stay and faster recovery (4,5,7). A single mini-incision technique is most commonly used and a posterior, lateral or anterior approach can be chosen. The posterior approach is a well-known approach with a good exposure of the femur and preservation of the gluteus medius and minimus muscles. However there is an increased risk of dislocation due to the section of the posterior capsule and external rotators. The lateral approach has a lower dislocation rate, but involves the detachment of the gluteus medius from the trochanter with a higher incidence of post-operative limping (8). The anterior approach is a true inter-nervous and inter-

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muscular approach to the hip, requiring little or no muscle dissection. Its soft tissue-preserving nature and low dislocation risk has generated an increased interest over the last decade. A special positioning table (e.g. a Judet table) can facilitate the exposure of the femur during surgery, as described by Matta and has the advantage that the procedure necessitates the assistance of one or two persons only (13,15).

Initial reports showed successful results with the use of this technique performed by experienced surgeons (3,15,17). However, some reports showed high complication rates which brought the technique into question (12,18).

The aim of our study was to determine the early post-operative outcomes of minimal invasive anterior total hip arthroplasty with the use of a positioning table and report on the intra-operative and immediate postoperative complications. This could help to determine if it is a safe technique to use as a community hospital hip surgeon. We also wanted to study whether the complication rate changed over time in relation with the surgeon's learning curve.

MATERIALS AND METHODS

We retrospectively reviewed the prospectively collected data of a series of 300 primary total hip arthroplasties. A single surgeon (GDL) performed all of the operations in a period between March 2009 and March 2011, using a direct anterior approach with a positioning table. The operating surgeon has been in practice for more than fifteen years and used to perform all of his hip arthroplasties through a mini-posterior approach, before starting with the anterior approach in 2009. We identified 284 patients with a diagnosis of osteonecrosis, osteoarthritis, developmental dysplasia or rheumatoid arthritis. Two hundred sixty-eight patients underwent unilateral hip arthroplasty, sixteen patients had staged bilateral arthroplasties (Table I). All patients signed an informed consent form as required by the local hospital ethics committee.

The procedure was performed through an anterior Hueter minimal invasive approach as described by Laude (13), with the patient positioned supine on an orthopaedic extension table (AMIS Mobile Leg positioner, Medacta® and Rotex table®) and a modified Charnley retractor. No fluoroscopy was used during surgery. The implants used varied during the series. All acetabular components were press-fit, uncemented porous-types

with hard-on-hard bearing surfaces (ceramic-on-ceramic and metal-on-metal).

The patients were included in the Joint Care Program®, which includes a comprehensive education component and a standardized hospitalization and rehabilitation protocol. Rehabilitation started on the first postoperative day and patients were allowed to progress with weight bearing as tolerated. There were no specific precautions against dislocation. The patients were discharged from the hospital on the fifth day after surgery.

Post-op visits were scheduled at 4 weeks, 10 weeks and 1 year. Radiographic analysis was done on standard AP pelvic and lateral views at 4 weeks. We evaluated component positioning by measuring the abduction angle of the cup and the stem alignment. Varus or valgus angulation of the stem more than 3° was noted. The distance between the shoulder of the stem and the tip of the greater trochanter was measured and compared with the initial postoperative radiographs. A difference > 0.5 cm was reported as femoral subsidence.

One single orthopaedic surgeon (TDG) performed all the radiographic measurements. All known perioperative (intra-operative and immediate postoperative complications) were reported.

Data regarding clinical results were not complete and hence not reported in this study, because the aim of this study was to describe the perioperative results and complications, rather than the clinical outcome.

Statistical analysis was carried out using SPSS v19 (Statistical Package for the Social Sciences). Non-parametrical tests were used to compare different subgroups of our series (Fisher exact test, Pearson Chi-square test, Mann-Whitney U-test and Kruskal-Wallis test). Statistical significance was set at a p value < 0.05.

RESULTS

Our study group consisted of 165 males and 135 females. Only 3 patients were lost to follow-up at 1 year, giving a follow-up rate of 99%. Mean patient age was 69.8 years (range : 34-95 years). The right side was affected in 169 patients, the left side in 131 (Table I). The mean hospitalisation period was 6.4 days (SD : 1.6 ; range : 4-29).

BIOMET implants were used in 144 cases (48%) : Exceed cup in 123 cases (41%), M2a 38 cup in 21 cases (7%), Taperloc stem in 144 cases (48%).

MEDACTA implants were used in 156 cases (52%) : Versafit cup in 156 cases (52%) ; Quadra

Table I. — Implants/ surgical details

	Mean	SD	
Age (years)	69.79	71.56	
Hospital stay (days)	6.4	1.6	
	Number	%	
Gender			
	male	135	45.0
	female	165	55.0
side			
	left	123	43.3
	right	161	56.7
	bilateral	16	5.6
CUP			
	Exceed	123	41
	M2a 38 cup	21	7.0
	Versafit	156	52.0
STEM			
	Taperloc	144	48.0
	Quadra	102	34.0
	Amis	54	18.0

stem in 102 cases (34%), Amis stem in 54 cases (18%).

There were 9 (3%) intra-operative complications (Table II). Three of them were trochanter avulsion fractures. They mostly occurred while mobilizing the femur to gain exposure to the femur or during broaching of the femoral canal. These fractures did not require internal fixation, and all three went on to uneventful recovery. Four fractures of the proximal calcar occurred during broaching. Three were treated by cerclage wiring, one was successfully managed by screw fixation. Two femoral perforations occurred during preparation of the femur before broaching. Both were noted intra-operatively and needed no further treatment.

We did not observe any acetabular or ankle fractures.

There were 42 postoperative complications (14%) (Table II).

The major finding was 5 proximal peri-prosthetic femoral fractures, not noticed during surgery. Four fractures were seen on the post-operative radiographs, the fifth fracture was detected after fifteen

days, when the patient was readmitted from the rehabilitation centre because of progressive pain without a history of trauma. Four of these fractures required revision surgery. Two femoral fractures were significantly displaced. They were managed by removing the cementless stem and replacing it with a cemented stem after reduction and cerclage of the femur. In the other two cases the stem was left in place and the fracture was treated by cerclage (Fig. 1-3). The fifth fracture was treated conservatively and healed without any signs of subsidence. All of these fractures occurred with the Quadra and AMIS stems and all five patients were older than 80 years.

Two patients (0.66%) had an anterior dislocation of their prosthesis. The first patient presented with a dislocation one day after surgery and underwent a closed reduction under general anaesthesia. The second patient dislocated two times and was therefore revised to a femoral head with longer neck length. One patient had a displacement of an acetabular implant which required revision surgery with cup revision at day 4. One cup had to be revised because it was positioned too steep. In another patient an acetabular liner malposition was noted on the post-operative radiograph. Although asymptomatic, open reduction of the liner was performed.

There were 10 post-operative infections (3.3%). Seven patients had a post-operative wound infection. Four were managed successfully with antibiotic suppression, three required surgical debridement and irrigation. Three (1%) patients developed a chronic deep infection requiring two-staged revision.

There were two (0.66%) wound haematomas requiring debridement and one patient (0.33%) returned to the operation room for bleeding of the circumflex artery.

Sixteen patients (5.33%) mentioned a burning sensation on the anterolateral thigh, due to irritation of the lateral femoral cutaneous nerve. All but one resolved spontaneously over time. One patient required a re-intervention due to a painful neuroma.

Overall, 20 patients (6.67%) required a surgical re-intervention (Table III).

One patient was diagnosed with a non-fatal pulmonary embolism at 6 weeks and another patient, an 84-year old male died unexpectedly 5 days after

Table II. — Complications
(LFCN : lateral femorocutaneous nerve)

Type of complication	No of patients	%
Intraoperative complications	9	3.0
Femoral fractures	7	2.33
Calcar	4	1.33
Greater trochanter	3	1.00
Acetabulum	0	0.00
Femoral perforations	2	0.67
Postoperative complications	42	14
Peri-prosthetic femur fractures	5	1.67
Infection	10	3.33
Superficial	4	1.33
Deep	6	2.00
Debridement and lavage	3	1.00
Requiring 2-stage revision	3	1.00
Other complications		
LFCN injury	16	5.33
Wound haematoma	2	0.67
Anterior dislocation	2	0.67
Bleeding circumflex artery	1	0.33
Cup loosening	1	0.33
Cup malpositioning	1	0.33
Liner exchange	1	0.33
Non fatal lung embolism	1	0.33
Death (unknown cause)	1	0.33
Femoral fracture after epileptic fit	1	0.33

surgery, despite an uncomplicated post-operative course. One peri-prosthetic fracture, type Vancouver C occurred three months after surgery due to an epileptic fit.

Analysis of the radiographs taken at 4 weeks showed a median acetabular cup abduction angle of 47° (IQR 43-51). Two hundred and seventy-three cups (91.6%) were positioned in the (target) range of 35 – 55°. Seventeen of the 24 outliers (70.8%) occurred during the first 100 patients of the series. Analysis of the radiological data regarding the acetabular implant position showed significantly steeper cup positions throughout the first hundred

cases compared to the second and third 100 cases. (Mean = 50.2° vs 45.1° and 46.1° with $p < 0.01$).

Six femoral components (2%) were positioned in more than 3° of varus or valgus alignment relative to the diaphyseal femoral canal. In all other cases the stem was well centred in AP and lateral views. There was one case of femoral stem subsidence more than 0.5 cm, without clinical significance.

Seven patients (2.33%) developed heterotopic ossification. All of them were graded Brooker class I (5 patients) or II (2 patients), and none of them caused impingement or clinically significant loss of range of motion.

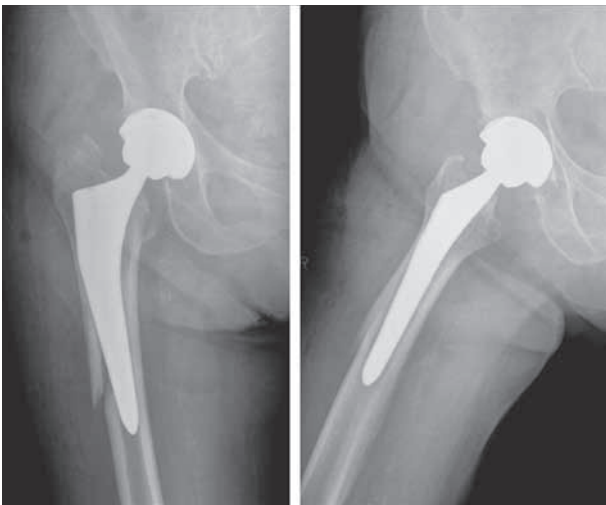


Fig. 1. — Peri-prosthetic fracture after THA

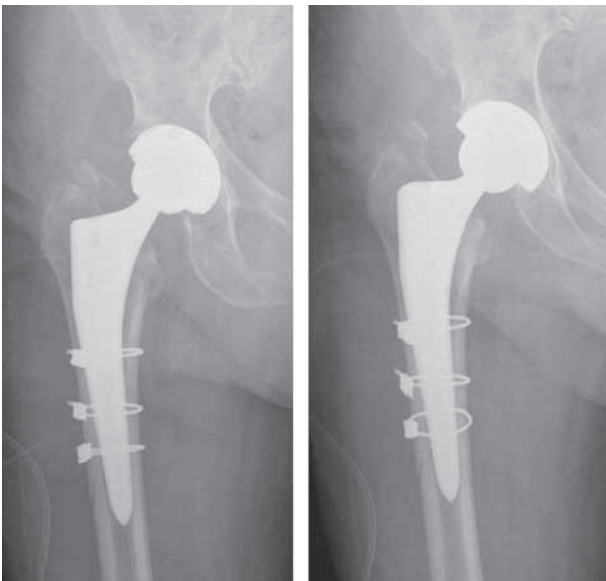


Fig. 2. — Peri-prosthetic femoral fracture treated with cerclage. The original stem was left in place.

DISCUSSION

In literature, there are relatively few studies regarding anterior total hip arthroplasty with a positioning table. Early reports showed a safe and reproducible technique with rapid functional recovery (*1, 15,16,17*). Later reports questioned the wide utilization of the technique due to the high number of

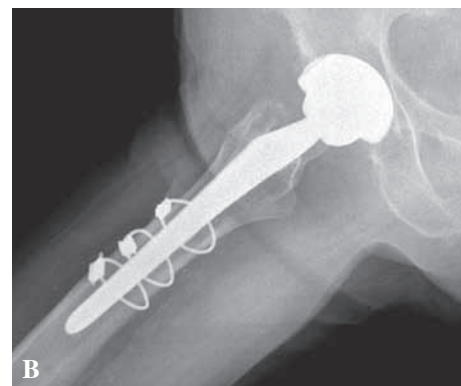


Fig. 3A-B. — One year post operative AP and lateral radiographs show complete bone healing.

complications, especially in the early cases of the series (*12,18*).

One of the main reasons for us to change from a posterior to an anterior approach was to reduce the risk of dislocation. Masonis and Bourne conducted a large meta-analysis of the dislocation rate according to the surgical approach (*14*). They found a dislocation rate of 3.2% for posterior approaches (3.9% in patients without posterior repair and 2.0% with posterior repair). In our series, dislocation occurred in two cases (0.66%), which is similar to other reports using this procedure (*12,15,16,17,18*) and relatively low compared with other approaches.

On the other hand, there has been some concern about the high number of femoral fractures induced

Table III. — Re-operations

Reinterventions	No of patients	%
ORIF for periprosthetic femoral fracture	4	1.33
Debridement and lavage for infection	3	1.00
Two-stage revision for infection	3	1.00
Debridement wound haematoma	2	0.67
Ligation bleeding circumflex artery	1	0.33
Exploration painful LFCN neuroma	1	0.33
Closed reduction anterior dislocation	1	0.33
Open reduction anterior dislocation	1	0.33
Cup revision due to loosening	1	0.33
Cup revision due to cup malpositioning	1	0.33
Open reduction liner malpositioning	1	0.33
ORIF femoral fracture after epileptic insult	1	0.33

by this procedure (12,18). Most fractures are fractures of the proximal calcar, treated by cerclage or screw fixation and greater trochanter fractures, which require no internal fixation. They usually occur during elevation and broaching of the femur. Most patients recover without complications after similar fractures. Our incidence of femoral fractures (4%) is in line with literature, which states that intra-operative femoral fractures are encountered in 1 to 5.4% of cases with the use of uncemented stems (6), while some authors report rates up to 27.8% with certain types of stem design and instrumentation (2).

The most concerning finding of our study however, was the displaced proximal femoral fracture which occurred in 5 patients. When looking at the femoral implants used we noted that all of the proximal femoral fractures occurred with the use of the same stem designs (Quadra and AMIS stems, Medacta®). There were no peri-prosthetic proximal femoral fractures in the group where a Taperloc stem was used. Statistical analysis showed a significant difference in the number of femoral fractures between the two implants ($p = 0.04$). In our opinion this suggests that femoral stem and instrument design might be a more important risk factor for intra-operative fractures than the use of a minimal invasive, muscle sparing approach. However, to our

knowledge, there are no other series reporting a high incidence of femoral fractures with the use of the Quadra and AMIS uncemented stems. The limited exposure of the femur may have contributed to the fact that some of these fractures were missed intra-operatively and resulted in post-operative peri-prosthetic fractures, requiring revision. This calls for the use of fluoroscopy during surgery when starting with the technique.

Horne and Olson stated that the fracture rate is inversely related to the experience of the surgeon and that a volume up to 200 cases is necessary to reduce the complication rate (11). This is consistent with our findings which showed a downward trend in the overall complication rate with growing experience, although no statistical significance could be shown. We did not note a similar trend when looking at the intra-operative fractures.

Another concern with the use of the anterior approach is the risk of injury to the lateral femoral cutaneous nerve. Although the anterior approach is advocated to be a true inter-nervous approach, the lateral femoral cutaneous nerve sometimes lies within the operation field and is at risk for injury. Injury to this nerve is not considered a major complication as would be a femoral or sciatic nerve palsy, but it can cause some discomfort for the patients. There are great differences in the incidence

reported in literature, ranging from zero up to 81% (1,3,10,16).

We listed the patients who complained of numbness and a burning sensation along the anterolateral thigh. Most of the LFCN irritations (14/16) were observed during the first 200 cases. Around the end of that series, the operating surgeon lateralised the skin incision, more directly over the belly of the tensor fasciae latae muscle to avoid the nerve. Since then there was a tendency towards less nerve problems, which can be explained by the lateralisation of the incision and the gain in experience with this technique by the surgeon.

Jewett and Collins reported high rates (4.6%) of post-operative wound complications in their large series (12). In our study group we did not observe that amount of wound problems. In our series there were six post-operative infections, with three patients requiring surgical debridement for deep wound infection, which is similar to their findings. Our deep infection ratio of 1% is comparable with the incidence of 1% as reported in literature (9). We did find a statistical difference in infection rate with more infections in the first 100 patients compared to the last 100 of our series (6 cases vs 0, $p = 0.03$).

Radiological analysis regarding the implant position showed significantly steeper cup positions throughout the first hundred cases compared to the next two hundred cases. The results in our second and third 100 patients show mean abduction angles of 45.07° and 46.13° respectively and only 3.5% outliers with cup abduction angles greater than 55°. Although it is more difficult to gain a good femoral exposure with the anterior technique, there were only two percent of the femoral stems placed in more than 3° of varus or valgus position. These findings support the findings of Matta *et al* (15) that the procedure allows accurate and reproducible component positioning, but some experience and familiarity with the technique seems to be necessary to obtain optimal results.

The weaknesses of this study are its retrospective design, the relatively short follow-up (1 year), the use of different femoral and acetabular implants and the lack of complete data regarding clinical hip scores. The purpose of the study however, was to report the short-term perioperative complications,

rather than the long-term clinical data and survivorship of the implants. Our study group is a relatively large, consecutive series of one surgeon with only a small number of patients (1%) lost to follow-up at 1 year.

Based on the results of our first 300 patients, we believe that surgeons starting with the anterior technique with a positioning table should be aware of the potential risk of femoral fractures and perforations and especially of occult proximal femoral fractures throughout their first one hundred cases. Implant design or implantation instruments may also play a role in the occurrence of femoral fractures. Confronted with these study findings we stopped using the Medacta femoral stem designs.

Altogether, there seems to be a significant learning curve with an important complication rate compared to other conventional approaches, which may be too high for some surgeons to change their surgical technique.

Once familiar with this technique however, we are convinced that it can offer a consistently accurate component positioning and fast postoperative recovery for the patients, with an acceptable complication rate and a low dislocation risk.

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