

# Facing complications of direct anterior approach in total hip arthroplasty during the learning curve

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**Summary.** *Background:* This study aims to evaluate complications and early postoperative clinical outcomes of direct anterior approach (DAA) in total hip arthroplasty (THA). *Methods:* Ninety-one consecutive patients who underwent primary elective unilateral THA between January 2013 and December 2019 were identified. Collected data included age of patient, BMI, ASA score, EBL (estimated blood loss), LOS (length of stay), operating time, and intra/postoperative complications. The recorded complications included prolonged wound drainage without infection, superficial and deep infection, dislocation, periprosthetic fracture, aseptic loosening or failure of osteointegration and nervous damage. Any reoperation, with or without prosthetic component revision, was recorded. *Results:* Fourteen complications (15,4%) and 12 (13,18%) postoperative anemizations were observed in this series. No deep infection was reported. Most common complications were nerve damage (3/91; 3,29%), greater trochanter fracture (3/91; 3,29%), and wound trouble (3/91; 3,29%). Two (2,19%) dislocations were reported. One (1,09%) intraoperative periprosthetic fracture was treated with cerclage wiring. One (1,09%) revision was needed for an acetabular mobilization. One patient (1,09%) had severe periprosthetic ectopic ossifications (Brooker 4), needing reintervention because of severe limitations of the range of motion (ROM). *Conclusions:* Complications rate in this study with THA by DAA is comparable to those reported in literature. DAA is a safe, efficient procedure but it needs a steep learning curve. ([www.actabiomedica.it](http://www.actabiomedica.it))

**Key words:** DAA (Direct anterior approach), THA

## Introduction

The number of primary total hip arthroplasty (THA) performed through a direct anterior approach (DAA) is increasing (1, 2). This approach utilizes an internervous and intermuscular plane between the tensor fascia latae and the sartorius muscles (3).

Proponents of the DAA believe this technique to be associated with less muscle damage, faster patient recovery and lower risk of postoperative hip dislocation (2, 4, 5).

However, it is important for surgeons adopting this approach to understand the potential complications and pitfalls in order to decrease the risk of failure and potential harm for patient.

In this study the results observed in a series of 91 cases were compared with those reported in the Literature in order to evaluate the risk of complication of DAA.

## Methods

A retrospective cohort study was performed. Ninety-one consecutive patients who underwent primary unilateral THA through DAA between January 2013 and December 2019 were identified. All operations were performed by the same senior surgeon since the beginning of his learning curve with DAA.

Collected data included the age of the patient, Body Mass Index (BMI), ASA score (6), EBL (estimated blood loss [preop Haemoglobin - postop Haemoglobin, g/dl]), length of stay (LOS), operating time, and intra/postoperative complications. Complications to be recorded included prolonged wound drainage without infection, superficial and deep infection, dislocation, periprosthetic fracture, aseptic loosening or failure of osteointegration and nervous damage. Any reoperation, with or without prosthetic component revision, was recorded. Prolonged drainage was defined as that which continues for more than ten days postoperatively requiring negative pressure therapy, compression dressings or changes in anticoagulation regimen. Superficial infection was defined as local infection without drainage that required and improved with antibiotics and without further surgery. Deep infection was defined according to MSIS (Musculoskeletal Infection Society) criteria (7, 8).

A standard institution protocol for all patients undergoing THA regardless of surgical approach was used for all patients during the study period. Primary cementless THA components were used (MicroPort Orthopedics™, Shanghai, China), without traction surgical table.

Short-term intraoperative antibiotic prophylaxis was administered within 60 minutes of the incision; all patients received routine thromboembolic prophylaxis using low-molecular-weight-heparin in addition to compression devices while they stayed in hospital, unless medical conditions, comorbidities or allergies necessitated the use of other prophylactic agents. All patients got prophylactic therapy for ectopic ossification in the same day of surgery with Indomethacin 150 mg/die for 6 days, excluding patients who suffer from gastrointestinal and cardiovascular diseases.

## Results

Demographics showed a mean age of  $69 \pm 10,3$  years (range 26-87); the mean BMI was  $27,79 \pm 4,3$  (range 17,6-39,7).

The mean ASA score was 2 (71 patients classified as 2, 19 as 3 and 1 patient as 1 ASA score) and the mean operating time was  $75 \pm 16,63$  minutes (range 61-130 minutes).

Only 12 patients needed blood transfusions (mean blood loss was  $4,02 \pm 1,26$  g/dl; range 1,2-6,7 g/dl); the mean LOS was  $6,24 \pm 2,25$  days (range 3-18 days). The patients were always discharged to an acute rehabilitation facility.

There were 14 complications, with an incidence of 15,4% (Table I).

Of these complications, 2/91 (2,19%) were due to superficial infection, 1/91 (1,09%) were due to prolonged wound drainage. No deep infections were reported. 1 (1,09%) periprosthetic fracture, 3 (3,29%) greater trochanter fracture and 2 (2,19%) dislocation during the early postoperative rehabilitation.

One patient (1,09%) had severe periprosthetic ectopic ossifications (Brooker 4) (9), and needed re-intervention because of severe limitations of the ROM.

One (1,09%) aseptic loosening (due to failure of osteointegration) was treated with revision of the acetabular component, with good postoperative results.

Two dislocations found in our series healed without further complications.

Finally, another complication in our series was the damage of lateral femoral cutaneous nerve (LFCN), with an incidence of 3/91 (3,29%). Most of cases were transient numbness/dysesthesia in the anterolateral region of the thigh. No lesions to the superior gluteal nerve were reported. Only one case (1,09%) referred long lasting numbness, without any functional limitation.

## Discussion and conclusion

The most common complications reported for DAA are:

**1 - Nerve Damage:** The DAA has evolved since its original description by Carl Heuter in 1870 with modifications by Smith-Peterson and Judet (10). The continuing evolution of the approach makes difficult interpreting the literature on lateral femoral cutaneous nerve (LFCN) injury reported rates as there are wide discrepancies, from 0,1 to 8,1% (11, 12). This is probably related to the variability in skin incision and deep dissection described for the anterior approach (13).

The LFCN is purely a sensory nerve, and injury generally manifests as numbness in the anterolateral region of the thigh; some patients report burning or

Table 1. Incidence of complications

Incidence	Cases	Complication
2,19%	2/91	Superficial infection
1,09%	1/91	Polonged wound drainage
1,09%	1/91	Periprosthetic fracture
3,29%	3/91	Greater trochanter fracture
2,19%	2/91	Dislocation
1,09%	1/91	Periprosthetic ectopic ossification
1,09%	1/91	Aseptic loosening
3,29%	3/91	Nerve damage

dysesthesia. LFCN neuropraxia rates range from 67% to 91% in some series (14) with no functional limitations reported by the patients and as measured by the SF-12, WOMAC, UCLA PROM scores.

Avoidance of this complication is possible with blunt dissection between the sartorius and tensor fasciae latae, by using a more lateral incision away from the lateral border of the sartorius muscle, careful dissection, and confining the DAA to the area inferior and lateral to the anterior superior iliac spine.

The terminal branches of the inferior branch of the superior gluteal nerve innervates the tensor fasciae latae being at potential risk during DAA (15).

Grob et al. performed an anatomical study with cadaveric dissection of the course of the nerve branch and found that that the nerve is at risk during the placement of retractors and coagulation of the ascending branch of the lateral femoral circumflex femoral artery (16).

Care must be taken during broaching: insufficient exposure may lead to direct damage to the fibres of the tensor fasciae latae muscle, including the motor nerve branches (17, 18).

In present study, only three patients report this complication; in two cases, the paraesthesia was transient and resolve within three months after surgery. Only one case present a persistent numbness, without any functional limitation due to purely sensitive nature of the LFCN.

**2 - Fracture Risk:** modified fractures traction table are commonly used in DAA for THA with a mobile foot attachment for rotation of the leg; the use

of these devices must be done with care, as fractures attributable to their unsafe use have been reported. Intraoperative fractures of the femoral shaft (0,8%) and greater trochanter (5,7%) are reported in some series (19-21).

The incidence of postoperative periprosthetic femoral fracture for primary cementless THA ranges from 0,47 to 7,1% (22). Advanced age, female sex, and BMI have been reported as risk factors; no significant associations where found among the different surgical approaches (23, 24).

Only one (1,09%) periprosthetic fracture was found in this series; a young woman sustain an intraoperative fracture, treated with cerclage wiring (Figure 1). No weightbearing was allowed in this case for the first month after surgery, but passive mobilization was carried on. The functional outcome at 6 months was excellent despite the intraoperative complication.

Prompt recognition during the primary surgery permit a better management and treatment of these complications.

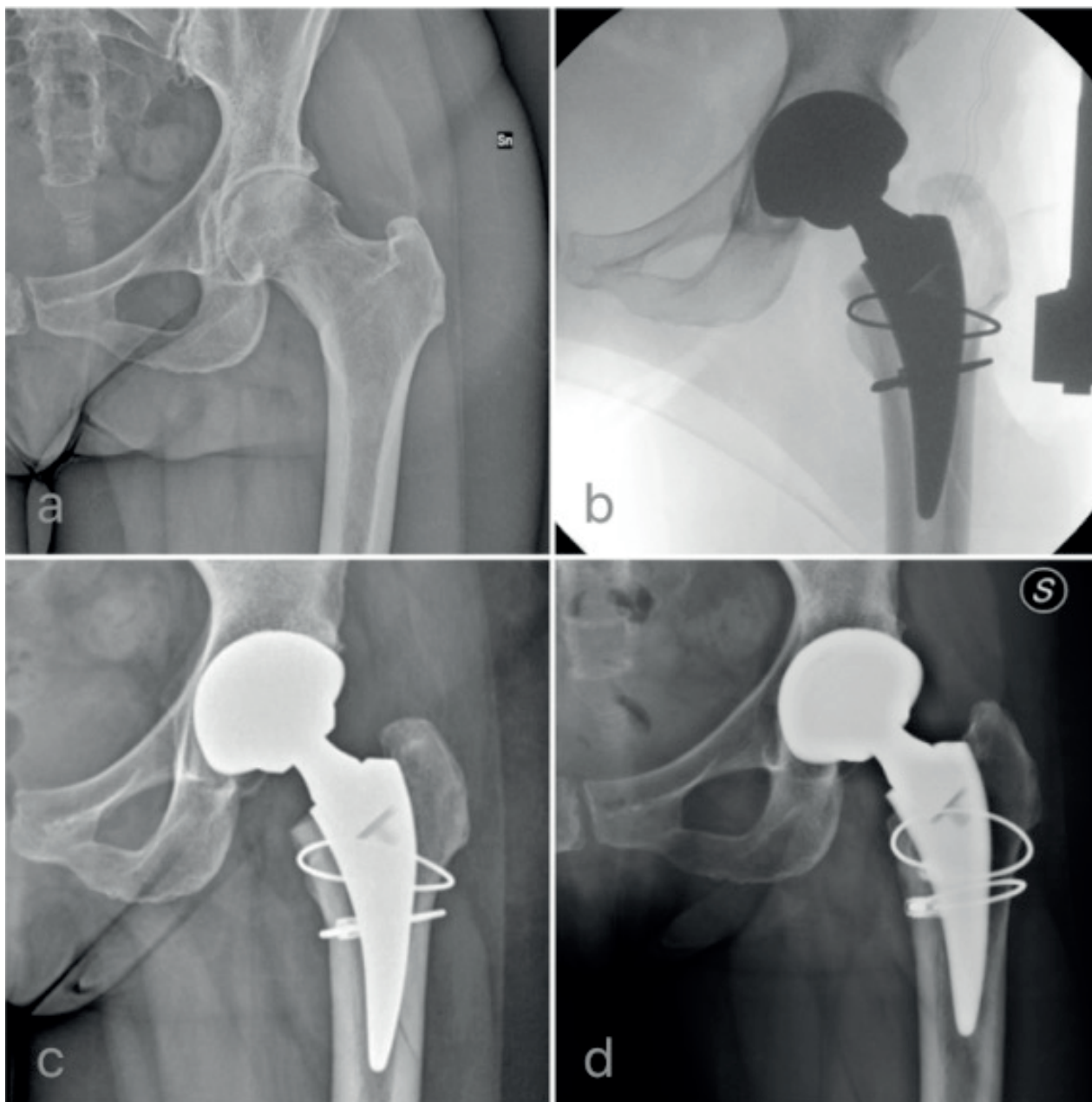
In this series 3 (3,29%) greater trochanter fractures among the first cases of the learning curve were recorded, which didn't require any treatment. They had only local pain for one month resolved at the follow-up.

**3 - Revision risk:** in the last decade there is a concerning trend of increasing early THA failures rates within 5 years of the primary procedure (25).

The literature is unclear about how that relates to the increase in DAA for THA (26); some series (27, 28) report early femoral failure as more common in patients operated by DAA. However, the same authors also found revision for acetabular component failure more common in patients with a posterior approach.

A study published in 2015 (29) evaluating a total of 42 438 primary THA's found no differences in risk of septic or aseptic revision between the DAA, antero-lateral, or posterior approach for THA. They also report a lower risk of hip dislocation for the antero-lateral and direct anterior approach when compared to posterior approach.

We reported 2 (2,19%) cases of dislocation. One, a young female, sustained an early dislocation during the immediate postoperative rehabilitation protocol. After reduction, a hip abduction brace was worn for



**Figure 1.** Clinical case of periprosthetic intraoperative fracture with DAA. (a) Preoperative x-ray; (b) intraoperative x-ray showing the fracture treated with cerclage wiring; (c, d) postoperative x-ray images at 1 and 6 months in which healing of the periprosthetic fracture is showed

three weeks. No recurrent dislocations were reported later, with a good functional result at 6 months. Another patient, a 75 yo male, sustained 2 dislocations. In both cases, surgical revision was not necessary.

Revision surgery was deemed necessary in only one (1,09%) case. It was an aseptic loosening of the acetabular component, due to failure of osteointegration.

Revision surgery with implantation of acetabular cemented cup was necessary. The patient report satisfactory outcomes, despite a minimal limitation in hip flexion (95°).

**4 - Blood Loss:** the blood loss after THA may be evaluated in various way (surgeon estimation of intraoperative blood loss (EBL); post-operative drain

output; number or necessity of transfusion; change in serum haemoglobin or haematocrit levels). This heterogeneity in evaluation makes literature conflicting to be interpreted. It's difficult, given the available literature, to draw any conclusion about blood loss in DAA; some series found no differences in operative blood loss/transfusion/Hb-Hct levels between DAA compared to posterior approach (30, 31).

The source of bleeding could be the ascending branch of the lateral circumflex artery, that can be damaged during the preparation of the femoral canal or improperly ligated/coagulated (32).

The mean blood loss in our series was estimated to be  $1258 \pm 402,6$  ml; only 12/91 (13,18%) needed blood transfusions postoperatively. The mean age was 69; the older the patients, the higher was the risk for blood transfusion, probably due to comorbidities.

**5 - Wound complications and infection:** reducing wound complication and deep surgical site infection is paramount in every THA procedure. The literature report conflicting data about the rates of wound complication in DAA; two series report a reoperation rate for wound infection/wound necrosis of 1,6% and 1,4%, respectively for DAA and posterior approach. (33, 34). However, the deep infection rate was comparable to series of alternatives approach (0,8%).

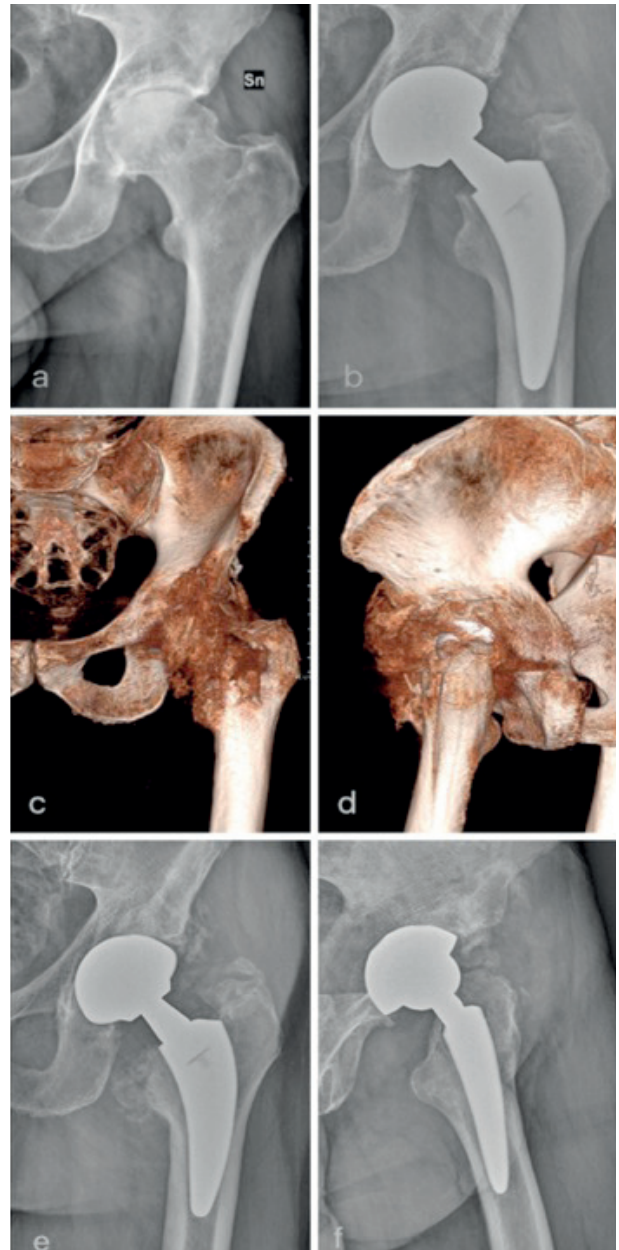
Another study (35) evaluated obesity as a risk factor for wound complication. Obesity has been shown to be a risk factor for wound complication and surgical site infection in THA regardless of approach (36, 37); the proximity of the anterior skin incision to the inguinal skin crease with overlying abdominal pannus in obese individuals may explain a high rates of reoperation for wound complication in obese patients (BMI > 40) (38, 39).

In our series, wound complications were reported in 3/91 patients (3,29%). All the patients heal with dressing and a brief administration of oral antibiotics. No deep infection was reported.

**6 – Ectopic ossifications:** onset of ectopic ossification is a common complication following THA. The incidence is up to 30% according to Łęgosz et al. (40).

Anyway, there is no agreement in the literature on the real incidence of this pathology, even if the prevalence is probably underestimated because only the severe cases are reported. In our study we reported 1

case (1,09%). There are several risk factors that predispose the population to develop ossifications. These are listed in the study from Zhu: male gender, cemented arthroplasty, bilateral procedure rheumatoid, arthritis, ankylosing spondylitis (41). Attention must be paid to



**Figure 2.** Clinical case with severe periprosthetic ectopic ossifications which required revision surgery: (a) preoperative x-ray; (b) postoperative x-ray at 1 month after THA; (c, d) 3D CT scan, anterior and posterior views respectively, of Brooker's grade 4 ectopic ossifications; (e, f) post-operative x-ray image after surgical removal of ectopic bone formations.

patients who suffered from these medical conditions because they are at high risk of develop ectopic ossifications and prophylactic postoperative therapy should be commenced. In our series all patients got prophylactic therapy in the same day of surgery with Indomethacin 150 mg/die for 6 days, excluding patients who suffer from GI and CV diseases. Just in 1 case (1,09%), as abovementioned, the complication was reported, and it was classified as 4 in Brooker's classification (Figure 2 a, b, c, d). The patient was affected by limited ROM due to pain (0-80° of flexion) and it was decided to candidate patient for surgical removal of heterotopic bone formations (Figure 2 e, f). Post-operative course was characterized by femoral nerve stupor that caused extension knee deficit and numbness at the level of thigh and saphenous nerve territory. At 1 month after discharge patient was able to walk with one crutch aid, pain was disappeared, and full movement of the hip was achieved.

Complications recorded in this study are similar to those commonly reported in the literature.

Understanding the potential complications of DAA is important and can help decrease risks for patients. The surgeon should be familiar with the procedure and carefully trained specifically for DAA, especially during the learning curve (42).

The most common complications reported are nerve damage; careful planning of incision and dissection should be made to avoid the risk of injury to the LFCN.

Conflicting evidence in the literature makes it difficult to draw conclusions about the long-term superiority of DAA for THA; a growing body of evidence otherwise points towards superiority in early recovery and functional outcomes with DAA in experienced hands compared to posterior and lateral based approaches.

**Conflict of interest:** Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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