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Research Article

Transitioning to the Anterior-Based Muscle-Sparing Approach in Total Hip Arthroplasty: Early Experience, Learning Curve and Practical Pearls from the First 50 Cases

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Abstract

Background: The Anterior-Based Muscle-Sparing (ABMS) approach for Total Hip Arthroplasty (THA) preserves musculature, allows supine positioning without a traction table and facilitates early recovery. This report describes a single surgeon's early experience transitioning from the direct lateral to the ABMS approach, emphasizing the learning curve, perioperative challenges and short-term functional outcomes.

Methods: A retrospective case series of 50 consecutive primary ABMS THAs (including five staged bilateral procedures) performed between 2023 and 2024 was reviewed. Surgical time, intraoperative complications and early postoperative recovery were recorded. Functional outcomes were assessed using the Modified Harris Hip Score (mHHS) at baseline, 2 weeks, 6 weeks, 3 months and 1.5 years. Statistical analysis was performed using repeated-measures ANOVA with significance set at $p < 0.05$.

Results: The mean operative time decreased from 210 minutes in the first 10 cases to 60 minutes in the last 15. Mean mHHS improved from 48.2 preoperatively to 70.3 at 2 weeks, 83.7 at 6 weeks, 91.1 at 3 months and 94.5 at 1.5 years ($p < 0.001$). Early complications included three non-displaced greater trochanter fractures, all treated conservatively without residual gait disturbance. No infections, dislocations or thromboembolic events were reported.

Conclusion: The ABMS approach demonstrated favorable short- and mid-term outcomes and a manageable learning curve in this early experience. Despite minor complications during the initial cases, the technique proved safe and reproducible for surgeons transitioning from the direct lateral approach.

Level of Evidence: IV

Keywords: Total Hip Arthroplasty; Anterior-Based Muscle-Sparing Approach; Learning Curve; Minimally Invasive Hip Surgery; Functional Recovery

Introduction

Total Hip Arthroplasty (THA) remains one of the most successful procedures in orthopedic surgery, with continuous refinement of surgical approaches to optimize recovery and functional outcomes. Among conventional techniques, the direct lateral approach has long been favored for its reliable exposure of both the acetabulum and femur. However, this approach involves splitting or detachment of the abductor muscles-particularly the gluteus medius-which may result in postoperative weakness or a Trendelenburg gait [1-3]. Published series report postoperative abductor insufficiency in up to 20% of cases following lateral approaches [2,3].

In recent years, minimally invasive and muscle-sparing approaches such as the Direct Anterior (DAA) and Anterior-Based Muscle-Sparing (ABMS) techniques have gained prominence. Both aim to minimize soft-tissue disruption and preserve muscle

function, which can lead to accelerated rehabilitation and improved early outcomes [4,5]. The ABMS approach utilizes the intermuscular interval between the tensor fasciae latae and gluteus medius, providing a safe corridor that reduces the risk of Lateral Femoral Cutaneous Nerve (LFCN) injury commonly associated with DAA incisions near the anterior superior iliac spine [6,7].

The decision to adopt the ABMS approach was influenced by evidence supporting muscle preservation, reduced incidence of LFCN neuropraxia and comparable component orientation to traditional techniques [8,9]. This transition is particularly intuitive for surgeons familiar with the lateral approach, as both share similar anatomical landmarks. Nevertheless, the ABMS approach requires specific modifications in soft-tissue handling, patient positioning and instrumentation that demand technical adaptation and experience [10,11].

Comparative studies have demonstrated that anterior-based techniques yield faster mobilization, reduced postoperative limp and lower dislocation rates compared with traditional lateral or posterior approaches [10-12]. Furthermore, recent investigations have shown that the risk of LFCN injury is lower in ABMS than in DAA [6,13]. Learning curve analyses suggest that operative times and complications decrease significantly after approximately 20-30 cases [14,15].

The purpose of this study is to describe the early institutional experience and learning curve associated with transitioning from the direct lateral to the ABMS approach in total hip arthroplasty. Emphasis is placed on perioperative outcomes, technical considerations and practical recommendations for surgeons implementing this approach for the first time.

Materials and Methods

Study Design

A retrospective case series was conducted including 50 consecutive primary Total Hip Arthroplasties (THAs) performed using the Anterior-Based Muscle-Sparing (ABMS) approach between January 2023 and December 2024. All procedures were performed by a single surgeon transitioning from the direct lateral approach. Written informed consent for participation and data use was obtained from all patients.

Inclusion and Exclusion Criteria

Patients were eligible if they had degenerative hip disease indicated for primary THA, including osteoarthritis, avascular necrosis or post-traumatic arthritis. Exclusion criteria were revision THA, femoral deformity requiring custom instrumentation or incomplete follow-up data. Five patients underwent staged bilateral THA, resulting in a total of 50 procedures in 45 individuals.

Implants and Equipment

All implants used were Bioimpianti® (Milan, Italy) cementless total hip systems with press-fit acetabular components and hydroxyapatite-coated femoral stems. Ceramic-on-polyethylene bearings were used in all cases. Standard operating tables were utilized without traction devices. The Alexis Orthopedic Wound Protector was employed in all cases to minimize skin trauma and enhance exposure.

Surgical Technique and Technical Pearls

All surgeries were performed following a standardized technique derived from the description by Geller and McGrory [16]. The patient was positioned supine with the operative leg placed under the contralateral leg in a “figure-of-four” configuration to facilitate femoral exposure.

Key technical considerations for early adopters include:

1. *Technical Foundation and References*

My transition to the Anterior-Based Muscle-Sparing (ABMS) approach was grounded in the technique described by Jeffrey A. Geller and Brian J. McGrory, whose textbook provided a detailed anatomical and procedural roadmap. Their work served as the primary reference in adopting and standardizing the approach within my practice.

2. Skin Marking and Initial Approach

Precise preoperative marking is critical to minimize skin trauma and avoid muscle overstretching. My method begins by palpating the anterior superior iliac spine (ASIS), then moving two fingerbreadths distally and three fingerbreadths laterally. At that point, the skin incision is planned to extend 3 cm proximally and 4 cm distally. The incision can be lengthened if necessary. (Fig. 1). In the first cases, incisions exceeded 10 cm and led to significant skin trauma. To reduce this, we incorporated the Alexis Orthopedic wound protector, which markedly decreased skin damage and improved wound edge retraction.

3. Muscular Interval Dissection and Vascular Precautions

After the skin incision, the muscular and tendinous interval must be carefully identified. Locating perforating veins can assist in defining this plane. Once the tendinous plane is exposed, a longitudinal incision should be made approximately 1 cm posterior to the border, ensuring that a cuff of tendon remains for secure closure during wound closure. This approach not only facilitates proper visualization and access but also promotes optimal soft tissue healing postoperatively. The interval between the Tensor Fasciae Latae (TFL) and gluteus medius must be developed with care. Blunt dissection with fingers is strongly discouraged due to the risk of vascular injury. Instead, the internal fascia should be visualized and vessels identified and coagulated before continuing. Hemostasis at this stage is essential, as bleeding can significantly impair the visual field in this minimally invasive approach (Fig. 1).

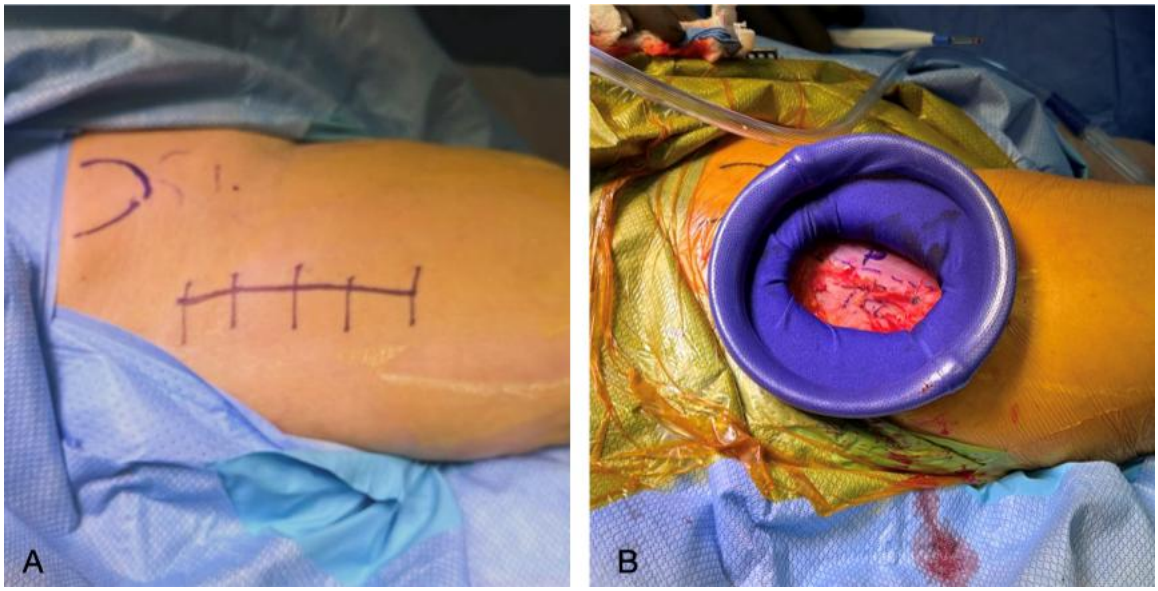

Figure 1: A: Demonstrates a 6-8 cm skin incision, referenced from the Anterior Superior Iliac Spine (ASIS). The incision is placed approximately 2 cm distal and 4-5 cm lateral to the ASIS; B: Exposure of the intermuscular plane between the tensor fasciae and surrounding structures.

4. Femoral Head Osteotomy

Following identification of the intermuscular interval and exposure of the articular capsule, attention is directed toward femoral head osteotomy. Two Hohmann retractors are placed to optimize visualization and protect surrounding structures: one retractor is positioned just medial to the lesser trochanter to retract the Tensor Fasciae Latae (TFL) and the second is placed posterior to the femoral neck to gently retract the gluteus medius.

The joint capsule is excised circumferentially to fully expose the femoral neck and head. At this stage, dislocation of the femoral head can be technically challenging, particularly in stiff or arthritic hips. Therefore, a double-cut technique is recommended. First, a proximal cut is made perpendicular to the femoral neck to resect a small segment approximately 1 cm thick of the neck itself. This maneuver allows easier access to the femoral head, which can then be extracted in a controlled fashion using an elevator or corkscrew. The second, more distal cut completes the osteotomy, facilitating removal of the remaining femoral head. This stepwise approach minimizes stress on surrounding soft tissues and reduces the need for excessive force during dislocation, thereby lowering the risk of iatrogenic fractures.

5. Acetabular Exposure

Acetabular exposure begins with complete excision of the anterior joint capsule, as capsular preservation offers minimal benefit in the ABMS approach and may hinder visualization. Once the capsule is removed, strategic and deliberate placement of Hohmann retractors is essential to optimize the working field and protect surrounding soft tissues. Three retractors are used to achieve adequate exposure: (Fig. 2). A Hohmann retractor in the anterior wall of the acetabulum, to provide anterior clearance. A posterior Hohmann, inserted into the posterior acetabular wall. This is perhaps the most critical retractor, as it effectively retracts the femur posteriorly and maintains exposure during reaming and cup implantation. A superior Hohmann placed along the acetabular dome, which enhances vertical visualization and facilitates instrument access. This three-point retractor configuration creates a well-balanced, unobstructed view of the acetabulum without requiring excessive force, allowing for precise acetabular preparation and cup positioning.

6. Femoral Preparation and Fracture Avoidance

Femoral exposure is the most technically challenging component of the ABMS approach and the most critical to avoid complications, particularly fractures of the greater trochanter (Fig. 2). Key technical steps:

- Complete release of the pubofemoral and posteroinferior capsule
- Use of a medial Hohmann retractor to shift the femur medially
- Elevation of the femur with a single-prong Hohmann placed anteriorly. Avoid wide or double-prong retractors, which increase the risk of trochanteric fractures

I perform these steps on a standard operating table, without the use of a traction table. The operative leg is placed under the contralateral leg in a "figure-of-four" position, allowing safe and reproducible femoral access.

Figure 2: C: Demonstrates acetabular exposure achieved with the use of three cobra retractors; D: Femoral exposure for broaching and stem insertion, facilitated by positioning the leg in a figure-of-four configuration.

7. Comparison with the Direct Anterior Approach

While both the ABMS and Direct Anterior Approach (DAA) are classified as minimally invasive, there are key differences (Table 1).

Feature	ABMS Approach	Direct Anterior Approach (DAA)
Muscle Interval	Gluteus medius - TFL	Sartorius - TFL
Risk to LFCN*	Lower	Higher (due to incision over ASIS)
Use of Traction Table	Not required	Frequently used
Femoral Exposure Difficulty	Moderate (varies by anatomy)	Often more difficult, steeper curve
Skin Healing	Better with Alexis retractor	May be limited by ASIS proximity
*LFCN = Lateral Femoral Cutaneous Nerve		

Table 1: Both the ABMS and Direct Anterior Approach (DAA) are classified as minimally invasive.

ABMS offers a safer corridor in terms of neurovascular structures and does not require special traction tables, making it more accessible and adaptable for most operating rooms.

8. Obese Patients: Feasible but Cautious

ABMS can be performed in obese patients, though the technical challenge increases substantially. Deep soft tissue planes can limit exposure and anatomical landmarks are harder to identify.

Recommendation: While obesity is not an absolute contraindication, preoperative weight loss should be encouraged to optimize visualization, reduce complications and facilitate rehabilitation.

9. Influence of Native Hip Anatomy

The ease of femoral exposure is highly dependent on the patient's proximal femoral anatomy:

- Coxa valga or normal neck-shaft angle: Exposure is generally straightforward
- Coxa vara: Exposure is considerably more difficult. These cases have:
  - Increased femoral neck horizontalization
  - Tighter soft tissues
  - Higher risk of greater trochanter fracture

In these patients, additional release of posterior structures, including short external rotators, may be required to mobilize the femur safely.

10. Postoperative Recovery and Rehabilitation

Patients are typically mobilized on postoperative day 1, using a walker or cane for approximately one week, depending on their balance and strength. Physical therapy should begin immediately with focus on gait training and hip range of motion.

A common postoperative complaint is groin pain, reported in the first 6 weeks and gradually resolving:

- Most patients improve by 3 months
- Some residual discomfort may persist up to 6 months

No patients in this series required extended inpatient stay or rehabilitation admission. Importantly, despite the early complications (e.g., trochanteric fractures), no patients developed Trendelenburg gait.

11. Final Thoughts and Recommendations for Beginners

Adopting the ABMS approach can lead to excellent outcomes with reduced soft tissue disruption, preserved muscle function and faster recovery. However, the learning curve is real and caution is warranted in early cases.

Final Tips:

- Begin with non-complex anatomy (avoid coxa vara and high BMI early on)
- Respect the interval, avoid forceful retraction
- Avoid using fingers for blunt dissection around vessels
- Use a single-prong retractor on the femur
- Don't hesitate to extend the incision early on to maintain safe exposure, typically within 24-48 hours

Outcome Measures and Statistical Analysis

Clinical outcomes were assessed using the Modified Harris Hip Score (mHHS) at baseline, 2 weeks, 6 weeks and 3 months and 2 years postoperatively. Surgical time, intraoperative events and postoperative complications were recorded. Data were analyzed using repeated-measures ANOVA to compare mHHS values across time points, with significance defined as $p < 0.05$. Descriptive statistics were used for demographic and perioperative variables.

Results

A total of 50 primary Total Hip Arthroplasties (THAs) were performed using the anterior-based muscle-sparing (ABMS) approach between January 2023 and December 2024. The series included 45 patients (five underwent staged bilateral procedures). The mean age was 63.4 ± 7.9 years (range, 49-79) and the cohort comprised 27 women and 18 men. The mean body mass index (BMI) was 28.7 ± 3.9 kg/m².

Functional Outcomes

The Modified Harris Hip Score (mHHS) improved significantly from baseline to all postoperative time points and remained stable at 1.5 years. Preoperative mHHS: 48.2 ± 6.4; 2 weeks: 70.3 ± 5.9; 6 weeks: 83.7 ± 4.8; 3 months: 91.1 ± 3.5; 2 years: 94.5 ± 2.8. A repeated-measures ANOVA demonstrated a statistically significant improvement across all intervals ($p < 0.001$).

Operative Time and Learning Curve

Operative time declined markedly as experience increased: first 10 cases, 210 ± 28 min; cases 11-35, 120 ± 22 min; final 15 cases, 61 ± 12 min.

Complications

Early complications were limited to three non-displaced greater trochanter fractures (6%), all in the first 10 cases, treated non-operatively with full recovery. No infections, dislocations, neurovascular injuries or thromboembolic events occurred. No Trendelenburg gait or LFCN symptoms were recorded throughout follow-up.

Recovery and Hospital Course

All patients ambulated on postoperative day one. Walking aids were discontinued within a median of 10 days. Transient groin pain occurred in 82% of patients during the first 4-6 weeks, resolving by 3 months. No readmissions or inpatient rehabilitation were required.

Implant Performance

All Bioimpianti® components demonstrated stable fixation with no evidence of migration, subsidence or osteolysis at 1.5 years.

Discussion

This study describes the early and mid-term outcomes of a single surgeon's transition from the direct lateral to the Anterior-Based Muscle-Sparing (ABMS) approach for Total Hip Arthroplasty (THA). The findings confirm that the ABMS technique can be safely adopted with reproducible results and a manageable learning curve. To our knowledge, this is one of the few Latin American series reporting a complete 2-year follow-up after adopting the ABMS approach. The key benefits observed were preservation of abductor function, low complication rates and rapid functional recovery. No patient developed Trendelenburg gait, contrasting with the well-documented risk of postoperative abductor weakness following the lateral approach [1-3,19]. These findings support previous reports indicating that anterior-based approaches reduce soft-tissue damage and accelerate early rehabilitation [10-12,20].

Importantly, no Lateral Femoral Cutaneous Nerve (LFCN) symptoms were observed in this series. The ABMS interval-between the tensor fasciae latae and gluteus medius-lies further posterior than the direct anterior (Smith-Petersen) approach and therefore minimizes the risk of LFCN neuropraxia [6,21]. This neuroprotective advantage reinforces the safety of the approach for surgeons without access to specialized traction tables.

The three trochanteric fractures (6%) occurred early in the learning curve and were successfully managed without surgical intervention. This pattern is consistent with previous reports describing initial mechanical complications that decrease after the first 20-30 cases [13,22]. No other intraoperative complications or early dislocations occurred, reflecting the reproducibility of this muscle-sparing technique when performed under direct visualization.

The progressive reduction in surgical time-from over 3 hours in initial cases to 1 hour after approximately 30 cases-illustrates the technical adaptability of the approach. Previous studies by De Steiger, et al. and Dall'Oca, et al., have reported similar trends, with proficiency achieved after approximately 25 procedures [14,22]. The absence of infections or thromboembolic events also underscores the safety profile of the ABMS approach in routine practice.

Functional results demonstrated significant improvement in mHHS from baseline to 2 years ($p < 0.001$), with stabilization after 3 months, a trend that remained consistent for 1.5 years. These scores are comparable to or better than those reported for other minimally invasive techniques [15,23]. Furthermore, all Bioimpianti® implants achieved stable fixation without migration or osteolysis, supporting their reliability in cementless ABMS procedures.

Limitations

The study's retrospective design, small sample size and absence of a control group limit statistical generalization. However, the uniform surgical technique, consistent follow-up and detailed technical description provide valuable insight into the transition process for surgeons adopting the ABMS approach.

Conclusion

The Anterior-Based Muscle-Sparing (ABMS) approach proved to be a safe and effective alternative for total hip arthroplasty during the surgeon's transition from the lateral approach. Despite a defined learning curve, short-term outcomes were excellent, with no Trendelenburg gait or LFCN injuries and significant improvement in functional scores. This early experience suggests that ABMS can be reliably adopted with proper technique, planning and attention to key anatomical landmarks.

Conflict of Interests

The authors declare that there is no conflict of interest related to this study.

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