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"Anterolateral" approach to the hip: a systematic review of the correct definition of terms

Andrea Cozzi Lepri, Marco Villano, Fabrizio Matassi, Christian Carulli, Massimo Innocenti and Roberto Civinini

Abstract

Purpose: The Watson-Jones interval plane between tensor fascia lata (TFL) and the gluteus medius (GM) has come back into fashion in the past few years - Röttinger described the anterolateral minimal invasive approach (ALMI) for use in total hip replacement, in which the standard Watson-Jones interval was used, but with a completely intermuscular plane. However, the term anterolateral is often still utilised to describe intramuscular approaches in which the GM was violated, thus creating a potential misunderstanding in the literature. Accordingly, we have designed a study to answer the following questions: (1) are there articles in the recent literature that use the term "anterolateral" to describe different approaches; (2) which would be the correct description of the anterolateral approach?
Methods: We did a systematic review of the literature based on PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, to look for peer reviewed papers of any evidence level focusing on the definition of anterolateral approach; MEDLINE and EMBASE were searched.
Results: 73 manuscripts met the criteria of the systematic search. 53 papers (72.6%) reported the term anterolateral approach to describe a complete intermuscular approach between the interval between GM and TFL. Nonetheless, in the remaining 20 papers (27.4%) the term anterolateral was used to describe intramuscular approaches in which the gluteus medius was violated.
Conclusion: In about 1 out of 4 papers in the recent literature, the term anterolateral was utilised to describe approaches that are completely different both in terms of anatomy and function.

Keywords
Anterior based muscle sparing approach, anterolateral minimal invasive approach, direct lateral approach, total hip arthroplasty

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Introduction

The term "anterolateral" for an approach to the hip was first described by Sayre in 1874 for resection of the upper end of the femur and later popularised by Watson-Jones in 1936 for management of fractures of the proximal femur.[1]

This approach utilised the interval plane between the tensor fascia lata (TFL) and the gluteus medius (GM) but a complete or partial detachment of the anterior fibres of the abductor muscles (medius and minimus) was always performed. This classic approach was later gradually abandoned to be superseded by transgluteal (Hardinge type) or postero-lateral approaches.[2]

In these past few years the term has come back into fashion - Röttinger has described the "anterolateral" minimal invasive (ALMI) approach for total hip replacement: the standard Watson-Jones interval was used, but with a complete intermuscular plane between the TFL and the GM, without incision or detachment of muscles and tendons.[3]

The ALMI is "anterior" to the GM and to the greater trochanter and thus is similar to all other anterior approaches to the hip, sharing their advantages: they are muscle sparing and do not violate the abductor muscles.[4–6]

Department of Health Sciences, Orthopaedic Unit, University of Florence, Italy

Corresponding author:
Andrea Cozzi Lepri, Department of Health Sciences - Orthopedic Unit - University of Florence, C.T.O. Largo Palagi 1, Firenze, 50139, Italy.
Email: andreaco84a@gmail.com

Thus, nowadays, the denomination of anterolateral approach should be used only to describe an approach in which the GM is left untouched.

However, the term "anterolateral" is still often utilised to describe approaches in which the gluteus medius is violated in some way (splitting, detaching, cutting): this creates a potential misunderstanding in the literature because such approaches should have been more correctly defined as "lateral" approaches.

For this reason Kelley has recently proposed naming the approach that utilises the Watson-Jones interval as the Anterior-Based Muscle Sparing (ABMS) approach so that it will not be confused with any other approach which involves detachment of the abductor muscles.[7]

Accordingly, we have designed a study to answer the following questions: (1) are there in the recent literature articles that use the term "anterolateral" to describe different approaches; (2) which would be the correct description of the term "anterolateral approach"?

Materials and methods

We carried out a systematic review of the literature, based on PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, to look for peer reviewed papers of any evidence level focusing on the definition of anterolateral approach.

EMBASE and MEDLINE (this one through PubMed) were searched using the following search strategies: "anterolateral" AND ("total hip replacement" OR "total hip arthroplasty"). Only full text papers published in English from 01 January 2005 to 31 October 2019 were included. Abstracts and conference proceedings were excluded. We choose 2005 as the starter year for the research because the term "anterolateral" minimally invasive approach in its modern meaning was first introduced by Röttinger in December 2004.

Furthermore, only studies in which a detailed description of the surgical technique was present were eligible for inclusion. Special attention was paid to analyze if the approach was intermuscular and anterior to GM or, if on the contrary, any kind of muscle detachment was performed (flow chart in Figure 1).

Ethical review committee statement: IRB approval not necessary.

Results

A total of 253 studies were identified from the keywords search. One hundred and eighty studies were excluded from the review. Overall, 73 manuscripts met the criteria for the systematic search.

53 papers (72.6%) reported the term anterolateral approach to describe a complete *intermuscular* approach between the interval between GM and TFL[3,8–51] most of the authors were from European countries, but authors from north America were also present.

In the remaining 20 papers (27.4%) the term anterolateral was used to describe *intramuscular* approaches in which the gluteus medius was violated in some way (splitting, detaching, cut) (Table 1) and that should have been more correctly defined as "lateral" approaches.

5 papers (3, 6, 11, 12, and 14 in Table 1) reported the term "anterolateral transgluteal" approach, which could be considered an oxymoron.

In 11 papers (4, 5, 8, 9, 10, 13, 15, 16, 17, 19 and 20 in Table 1), the description of the anterolateral approach reported detachment, dissection, division, cut or incision, and subsequent repair, of the gluteus medius.

In 4 papers (1, 2, 7 and 18 in Table 1), the term anterolateral was used to describe a gluteus splitting approach, which is a less invasive approach to GM, but which should not be considered a completely intermuscular approach.

Discussion

"The beginning of wisdom is the definition of terms", thus spoke Socrates almost 2600 years ago. The accuracy of definition drives the clarity of meaning that is intended to be imparted to the recipient of the written word: the greater the accuracy, the greater the clarity. It is therefore surprising to realise that 1 of the oldest and most common procedures in orthopaedic surgery, such as total hip arthroplasty, still lacks agreement on the definition of some of its approaches.

Historically, approaches to the hip joint were classified by eponymous or anatomic structures,[72] but nowadays muscle sparing has become more relevant for minimally invasive surgery and it is crucial to identify an approach as intermuscular or transmuscular.

Lateral or direct lateral approaches are those that pass through, or detach, the gluteus medius, so they are transmuscular. Thus, the term anterolateral approach is not synonymous with the lateral approach and can not describe a transmuscular approach.

We have demonstrated that even in the recent literature the term anterolateral was utilised to describe approaches that are completely different in terms of anatomy and function.

In our systematic review of the literature, 72.6% of the papers, mainly from European authors, utilise the anterolateral approach to describe an approach "anterior" to the trochanter in the interval between GM and TFL. This is a complete intermuscular approach and does not violate, even minimally, the GM. We have to realise that this approach is completely different from lateral approaches and is actually similar in many features to the direct anterior approach.

On the other hand in the 27.4% of the papers of our systematic review under the term of anterolateral have been described approaches which pass through, detach or split the gluteus medius. Furthermore, it is common

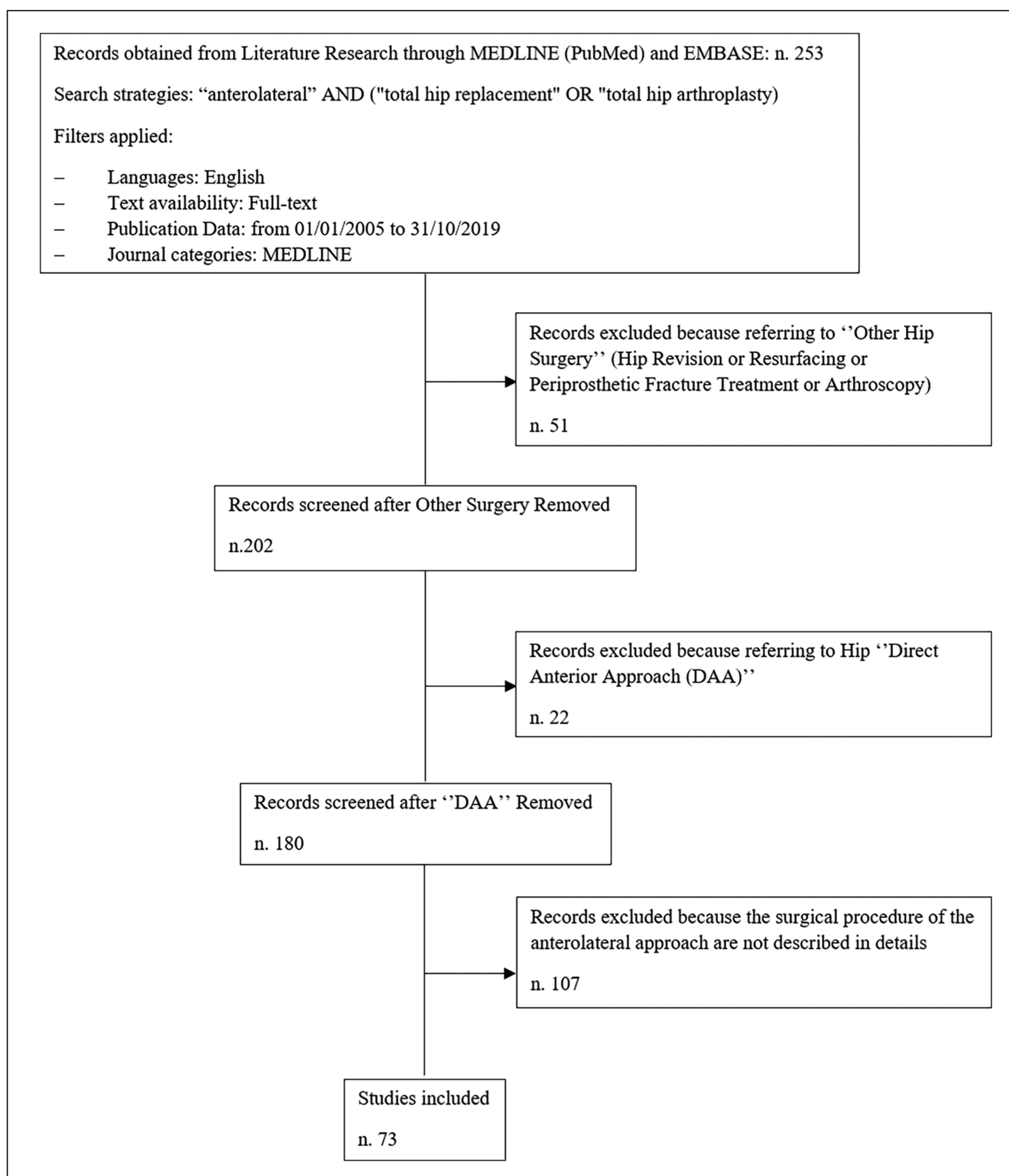

Figure 1. Flow chart of the analysis of the literature.

knowledge that among the North American orthopaedic community the term lateral or anterolateral are often considered synonymous.

The need to define the 2 approaches with different terms is crucial for clinical comparative studies, since it has been widely demonstrated in the literature that anterior, intermuscular approaches have a better outcome compared to intramuscular lateral approaches,[73–75] but not compared to the "true" anterolateral approach, as we have verified with superficial electromyography: a similar muscle recruitment pattern and functional recovery was found after THA conducted with an anterolateral and direct anterior approach, underlining the similarity in outcomes between the 2 approaches, that more correctly are both "anterior", widening the meaning of the term.[51]

Failing to differentiate anterolateral from lateral approaches, would produce incorrect evaluation of clinical results even in a systematic review and meta-analysis. In a recent study Yoo et al.[68] on gait analysis after total hip arthroplasty using direct anterior approach (DAA) versus anterolateral approach, concluded that gait speed and peak hip flexion within 3 months after surgery were significantly higher in the DAA group than in the antero-lateral group. However, they describe the antero-lateral approach as a "modified Hardinge", performed detachment of the gluteus medius and anterior ⅓ of the minimus.[68]

The problem could be solved as proposed by Kelley to name the approach that utilises the intermuscular interval between GM and TFL as Anterior-Based Muscle Sparing

Table 1. Synopsis of the incorrect definitions of anterolateral approach.

	References	Description of the approach
1	**Smith TM et al.**[52] Clin Orthop Relat Res 2005. Isolated liner exchange using the anterolateral approach is associated with a low risk of dislocation.	**"(. . .) abductor splitting anterolateral approach** as described by Frndak et al."
2	**Smith TM et al.**[53] Clin Orthop Relat Res 2005. Metal-on-metal total hip arthroplasty with large heads may prevent early dislocation.	"Three hundred forty-two operative procedures were done through the **anterolateral abductor split approach** as described by Frndak et al."
3	**Mayr E et al.**[54] Bone Joint Surg Br 2006. Uncompromised quality of the cement mantle in Exeter femoral components implanted through a minimally-invasive direct anterior approach. A prospective, randomised cadaver study.	"(. . .) femoral components implanted straight through a standard **anterolateral transgluteal approach** were compared with those of 13 similar femoral components implanted in an angulated fashion through a direct anterior approach"
4	**Lin DH et al.**[55] J Arthroplasty 2007. Effects of anterolateral minimally invasive surgery in total hip arthroplasty on hip muscle strength, walking speed, and functional score.	"After the subfascial space is entered, (. . .) with a smaller **dissection of only one half** to two thirds of the gluteus medius"
5	**Meneghini RM et al.**[56] J Arthroplasty 2008. A randomized, prospective study of 3 minimally invasive surgical approaches in total hip arthroplasty. Comprehensive gait analysis.	"The mini-anterolateral approach was performed as described by Berger (. . .) with **elevation and subsequent repair** of the anterior one third of the gluteus medius and minimus tendons"
6	**Chen DW et al.**[57] J Arthroplasty 2009. Comparison of clinical outcome in primary THA by conventional anterolateral transgluteal or 2-incision approach.	"(. . .) by conventional anterolateral **transgluteal** or 2-incision approach"
7	**Austin MS et al.**[58] Clin Orthop Relat Res 2009. Acetabular orientation. Anterolateral approach in the supine position.	"The gluteus medius muscle is **bluntly split** at the junction of the anterior one-third and posterior two-thirds close to the greater trochanter"
8	**Palan J et al.**[59] Clin Orthop Relat Res 2009. Which approach for THA. Anterolateral or Posterior?	"(. . .) or by **partial detachment** of the anterior portion of the gluteus medius and minimus off the greater trochanter."
9	**Lugade V et al.**[60] Clin Biomech (Bristol, Avon) 2010. Gait asymmetry following an anterior and anterolateral approach to total hip arthroplasty.	"For the anterolateral approach THA (. . .) **The anterior one-third of the gluteus medius and minimus are detached** from the greater trochanter"
10	**Klausmeier V et al.**[61] Clin Orthop Relat Res 2010. Is there faster recovery with an anterior or anterolateral THA? A Pilot Study.	"The anterior one-third of the gluteus medius and minimus tendons are **detached**"
11	**Mouilhade F et al.**[62] Orthop Traumatol Surg Res 2011. Component positioning in primary THR: A prospective comparative study of two anterolateral approaches.	"The present study compared two THR approaches, the standard **anterolateral transgluteal** approach and a reduced anterolateral (mini-Watson-Jones or Röttinger)"
12	**Lindgren V et al.**[63] Acta Orthop 2012. The type of surgical approach influences the risk of revision in THA. A study from the Swedish Hip Arthroplasty Register.	"We searched the Swedish Hip Arthroplasty to compare the posterior and **anterolateral transgluteal** approach"
13	**Müller M et al.**[64] Arch Orthop Trauma Surg 2012. The direct lateral approach: impact on gait patterns, foot progression angle and pain in comparison with a minimally invasive anterolateral approach.	"The ventral aspect of the gluteus medius is then **detached** from the greater trochanter together with the underlying gluteus minimus"
14	**Sheth D et al.**[65] Clin Orthop Relat Res 2015. anterior and anterolateral approaches for THA are associated with lower dislocation risk without higher revision risk.	"A reduced risk of dislocation with increased risk of aseptic revision was observed in the **anterolateral transglutea**l approach as compared with the posterior approach with a specific implant type"
15	**Chomiak J et al.**[66] Hip Int 2015. Lesion of gluteal nerves and muscles in total hip arthroplasty through 3 surgical approaches. An electromyographically controlled study.	"the anterior third of the insertion of the gluteus medius and minimus muscles (GMED, GMIN) **are sharply detached** from the greater trochanter and the joint capsule is released from the straight head of the rectus femoris muscle"
16	**Tsai SW et al.**[67] Hip Int 2015. Modified anterolateral approach in minimally invasive total hip arthroplasty.	"An **incision** was made along the tendinous portion of gluteus medium insertion over greater trochanter"
17	**Yoo JI et al.**[68] BMC Musculoskelet Disord 2019. Gait analysis after total hip arthroplasty using direct anterior approach versus anterolateral approach: a systematic review and meta-analysis.	"an anterolateral approach (modified Harding, ALA) was performed **to detach** the gluteus medius and **anterior one-third** of the minimus to reach the hip joint and repair the muscle detached after insertion of the prosthesis"
18	**Debi R et al.**[69] BMC Musculoskelet Disord 2018. Acetabular cup orientation and postoperative leg length discrepancy in patients undergoing elective total hip arthroplasty via a direct anterior and anterolateral approaches.	"Gluteus medius and Gluteus minimus **are split** in line with their fibers"
19	**Tjur M et al.**[70] Clin Biomech (Bristol, Avon). 2018 Posterior or anterolateral approach in hip joint arthroplasty - Impact on frontal plane moment.	"the anterior third of the gluteus medius and minimus muscle insertion to the femoral bone were **cut**"
20	**Sobh AH et al.**[71] Arthroplast Today. 2017 Intramuscular hemangioma after total hip arthroplasty: an iatrogenic etiology.	"with **detachment** of the anterior one-third of the gluteus medius and minimus insertions from the greater trochanter"

(ABMS).[7] This is a good solution since it stresses the similarity of this approach to the direct anterior approach.

1 limitation of our study is be related to the exclusion of other databases and grey literature, the language limitations, and the inclusion of any level of evidence. However, due to the aim of our search, missing documents would not alter the results or the meaning of the review since we do not need the whole sample of papers to demonstrate the incorrect use of a term.

It is beyond the scope of this paper to draw any conclusions as to which terms might be right or wrong, but the primary aim of this paper is just to focus attention on the discrepancies still present in the recent literature on the standard terminology of approaches to the hip and in particular on the anterolateral approach that is used both for the GM preserving procedure and for GM detaching approaches.

Overall, failing to clarify the difference between lateral and anterolateral terms risks causing misunderstanding, especially between North American and European literature, since we have demonstrated that these terms are not always considered synonyms.

Conclusion

In conclusion, caution should be used with the term anterolateral for approaches to the hip, and we have demonstrated that the recent literature does not clarify such terms. A consensus conference would be desirable to further clarify the classification of hip approaches.

Declaration of conflicting interests

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