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Original Research Article

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Abductor Tear in Total Hip Arthroplasty: A Scoping Literature Review

Abdulrahman Hasan Alfageeh (Alfageeh AH)^{1*}

¹King Abdulaziz University, Rabigh Faculty of Medicine, Jeddah, Saudi Arabia

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*Corresponding author: Abdulrahman Hasan Alfageeh (Alfageeh AH) King Abdulaziz University, Rabigh Faculty of Medicine, Jeddah, Saudi Arabia

Abstract

Background: Tear of the abductor mechanism is a well-known problem. Most of the published studies in that regard comes from the sport literature but little have been published about it in the THA settings. Abductor mechanism plays a crucial part in hip stability and limb gait hence an injury to it can lead to pain, weakness, and instability after THA. Objective: To review all studies reporting on abductor tear or insufficiency in Total Hip Arthroplasty and present the current state of literature on that. Methods: The Author completed an electronic database search of PubMed, EMBASE and PubMed Central to identify any studies reporting on Abductor mechanism and Total Hip Arthroplasty from the date of inception of the databases until August 2018. The author followed the PRISMA guidelines. The author extracted and summarized data from the identified studies. Only Studies published in the English literature and reported data on Abductor mechanism tear with THA were included. Results: 566 studies were identified. 32 studies met the inclusion criteria and were included in this review. Tear of hip abductor in THA were reported to be between 11-25%. It was more prevalent in women, older age population with no association to comorbidities. There is no clear evidence that the incidence of abductor weakness is higher in lateral than posterior approaches, contrary to the popular opinion. Surgical reconstruction techniques for chronic abductor insufficiency showed good results in the short-term regarding pain and function. Conclusions: Abductor mechanism tear after THA is a known complication that should be considered in patients with substantial lateral hip pain, limb and weak abduction following THA. Repair of the abductors can improve pain, function, and limb in three fourth of the patients specially if identified and repaired early. Promising results have been published for abductor reconstruction procedures for recurrent or chronic tears in short term follow-ups but still lack the long-term results.

Keywords: Hip Abductor; Abductor Tear; Abductor insufficiency; Hip Replacement; total hip arthroplasty.

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I. INTRODUCTION

Total hip arthroplasty (THA) is a surgical intervention associated with a very high satisfaction rate and excellent outcomes [1]. However, there is still a small group of patients who have persistent pain after surgery. The causes of pain after total hip arthroplasty varies greatly; however, abductor tear or insufficiency is one cause of debilitating pain that often go unrecognized. The abductor mechanism of the hip is composed of the gluteus medius and minimus muscles and is integral for normal gait. Abductor tears are an underappreciated cause of pain in post arthroplasty patients. It is a well-known cause of pain, limping, and instability [2-7], and is responsible for implant and surgical failure, thus requiring further revision surgery [8]. The tears were considered similar to those of the better-known shoulder equivalent and therefore the term 'rotator cuff tear of the hip' was used [9]. Cause of abductor tears after THA is thought to be multifactorial including degenerative tearing, failed repair after THA, and postoperative tearing. Those tears can be found incidentally at the time of surgery, or it may arise as a result of damage to the superior gluteal nerve intraoperatively, or after surgery owing to mechanical failure of the abductor muscle repair or its detachment from the greater trochanter [10].

The diagnosis can be difficult: disruption of the gluteus medius and minimus muscle-tendon complex is often misdiagnosed as trochanteric bursitis or postoperative muscle weakness [11, 12] and it is a difficult problem to manage. If the diagnosis of Abductor Tears is suspected clinically based on presentation (pain, limping or Trendelenburg gait, weak abductor strength) it can be further investigated with imaging modalities such as Ultrasound or Magnetic

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Resonance Imaging (MRI). In the absence of clear secondary cause such as (Greater Trochanter fracture, suboptimal femoral offset, implants improper positioning or signs of loosening, damage to superior gluteal nerve) a trial of conservative management can be started [13]. Conventional treatment for these patients is initially analgesia, non-steroidal antiinflammatory drugs (NSAIDs), steroid injections and physiotherapy [14-16]. Surgical repair is usually reserved for few patients who do not respond to conservative measures [17, 18]. Acute Abductor tears are generally amenable for direct repair [19], but the chronic tears with deficient tissue and retraction remain a dilemma for the treating surgeon. More invasive intervention and complex reconstruction are usually needed to treat this type of tears. Different types of procedures were described for treating chronic abductor insufficiency with mixed outcome results published. Since most of the published studies regarding Abductor insufficiency comes from the orthopaedics sport literature, we aim in this current study to present the current state of literature on Abductor tear and insufficiency in Total Hip Arthroplasty setting and to summarize all available data discussing this issue. Hopefully this will pave the way for further studies to investigate specific aspects of this challenging problem in the future.

II. METHODS

Databases Search

A thorough literature review was conducted out in August 2018. The search in PubMed and EMBASE medical databases was done by the authors. The databases were accessed to identify studies dealing with Abductor teras or insufficiency in THA setting. The search included articles published from the time of inception until August 2018.

Key terms incorporated into the search were: abductor mechanism, abductor tear, hip abductor, hip rotator cuff, abductor insufficiency associated with the following terms: THR, THA, hip arthroplasty, hip replacement.

The following text was used to maximize sensitivity and specificity: "(abductors tear OR abductor insufficiency OR hip abductors) AND (Hip Arthroplasty OR THA)"

Inclusion criteria for the included studies were: articles published in the English language and reporting on Abductor mechanism tears in the Total Hip Arthroplasty setting. Exclusion criteria for the studies were: articles with no full text or published in foreign language.

The titles and abstracts were screened, and the full articles were accessed for relevant studies that satisfied all of the inclusion criteria. The reference lists of the remaining articles were manually assessed in an attempt to identify any additional relevant articles that had not been found in the initial database search.

The PRISMA (Preferred Reporting Item for Systematic Reviews and Meta-Analyses) guidelines were followed, and a flow chart was used to summarize the selection procedure of the reviewed studies (figure1).

Data Extraction and Reporting

Data was extracted from papers included in the scoping review by the author using a data extraction tool developed by the reviewer. The data extracted include specific details about the study methods, year of publication, aim, sample size, and key findings relevant to the review. All retrieved information from the papers were reported with descriptive analysis.



Fig-1: PRISMA flow chart showing study selection

III.RESULTS

Search

Using the PRISMA flow chart, the selection method of the reviewed studies is shown in (Figure 1). The initial search yielded 566 citations. After reviewing studies abstracts and titles for only relevant ones, the author was left with 55 studies. The author obtained the full text of these studies and reviewed them in detail. Another 23 studies were excluded either because of reporting on native hips abductor pathology or abductor deficiency in tumour of proximal femur replacement or were published in foreign language or were cadaveric and anatomical studies. The remaining 32 studies were included in our review. Of the retrieved studies, there were no randomized controlled trials. The included studies assessed different aspects of topics from

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incidence, clinical evaluation to imaging utility and management.

Epidemiology

Tears of the hip abductor insertion were first described by Bunker and termed rotator cuff tears of the hip. In his paper he studied 50 consecutive patients undergoing hip arthroplasty with mean age of 83.5 years and found (22%) of them to have a tear of the anterior one third of the gluteus medius and minimus tendons (figure 2).

Abductor tear has been reported to be between 11% and 25% in different studies [20, 9] and more commonly in women and older age population. In a prospective study of 176 consecutive patients who underwent elective THA using the direct lateral approach for OA, Howell *et al.* [21] reported that (20%) of the patients had degenerative pathology of the abductor mechanism, the majority of them are elderly women. Similarly, Hendry *et al.* [22] found that those tears are increasingly prevalent in women of advancing years and lower socioeconomic status. The etiology of abductor tears after THA is multifactorial and includes physiological degenerative tearing, iatrogenic failed repair after THA, and postoperative tearing [13].

Clinical Assessment

Typically, patients with abductor tear present with lateral-sided hip pain and a limb. Timing of symptoms is variable. Patients with pre-existing tears may experience a resolution of their arthritic groin pain and focus on lateral pain from an underlying tear that was masked previously. Patients with THA performed via an anterolateral approach may have a pain-free period postoperatively with index pain at the time of abductor repair failure. Likewise, patients without preexisting tears undergoing an abductor sparing approach typically have insidious onset of pain [13].Thus, during history taking one should focus on details of the pain as well the operative details including approach utilized and intra op events.

Regarding physical examination, Patient with abductor tear often demonstrates a Trendelenburg gait, tenderness at the tip of the greater trochanter, and weakness on abductor muscle strength testing. Patients can also have a positive "Trendelenburg" test when asked to perform single-leg stance on the affected side [2, 3, 18, 21-24]. A positive test result is identified in the patient who cannot maintain a level pelvis when viewed from behind and leans toward the affected side to maintain coronal balance. Patient should also be examined for any signs of leg length discrepancy as well as sign of hip instability.

Surgical Approach

Hip surgical approaches such as lateral and anterolateral that require a release of part of the abductor or where Superior Gluteal nerve is at risk have been generally connected to abductor tears and weakness. Some investigators looked into that matter to explore this relation. Weber et al. [26] in his series recorded that the incidence of abductor weakness when using anterolateral approach is 0.08%. Similarly, Lubbeke et al. [27] found a 0.7% incidence of abductor weakness when using lateral approach when he retrospectively reviewed a series of 2657 total hip replacements. In a systematic review, Jolles and Bogoch found no significant difference in terms of positive Trendelenburg tests between posterior and direct lateral approaches. Postoperative limping secondary to abductor weakness ranged from 4% to 20% after lateral or anterolateral approaches and from 0% to 16% after a posterior approach [28]. A prospective study of 40 patients that investigated superior gluteal nerve damage in direct lateral hip approach using an EMG showed that (42.5%) had damage to the nerve detected by EMG but not manifested clinically at 2 weeks postoperatively. However, the damage tends to improve spontaneously and does not seem to cause clinically apparent abductor insufficiency at 6 months. Khan et al. [29] reported a 6.8% incidence of superior gluteal nerve injury at the time of surgery with a direct lateral approach [26]. In a clinical evaluation supported by electromyography (EMG) studies, Baker noted a significantly higher incidence of superior gluteal nerve palsy two weeks after surgery in patients who underwent a direct lateral approach as opposed to a modified lateral or posterior approach [30]. However, three months post-operatively there was no difference between the groups.

Imaging

Different imaging modalities were utilized in hip abductor tear evaluation. While plain radiograph does not directly show the tear, some valuable information can be obtained when assessing for abductor tears. Implants position, femoral offset, leg length discrepancy and prosthesis loosening are all associated with abductor weakness or tear. Ultrasound might be useful in evaluating abductor but is known to be an operator dependent modality that require experience which makes it less desirable option for most of the surgeons. Garcia, Picado and Nogueira-Barbosa [31] noted an overall incidence of 20.6% of abductor tendon tears one year after THR using this technique. However, only 11.7% of their patients were clinicallv symptomatic and had а positive Trendelenburg test. Of the eight patients who had clinical abductor weakness, only four had positive ultrasonography. Based on these findings, the authors concluded that ultrasonography could play a role in the diagnosis of abductor tendon tears, although it remained highly operator dependent. In a retrospective study of 33 patients, Ylinen et al³² observed that all 14 patients with positive arthrographic findings were known to have gluteal tears intra-operatively. However, nine of the 19 patients with negative arthrograms had similar findings at surgery, meaning that this test had low specificity, which makes it unattractive especially as it is invasive and risks introducing infection. MRI remains the modality of choice for assessing abductor tear and a new "metal subtraction" techniques and sequences reduce metallic artifact and aid in identifying pathology adjacent to THA implants. In a prospective study of 64 THRs (25 asymptomatic and 39 symptomatic) one year after surgery, Pfirrmann et al. [33] found a significantly higher incidence of tears of gluteus minimus and medius. There were signal changes and fatty atrophy of the gluteus medius tendon in symptomatic patients. Müller et al. [34] in a prospective study of 38 patients subjected to either a modified lateral approach or an anterolateral minimally invasive approach, noted a 50% incidence of abductor tendon tears and fatty atrophy at one year postoperatively that did not correlate with the clinical findings, reported levels of pain, degree of satisfaction or Harris hip scores. Although MRI appears to be a very sensitive but not very specific investigation, the results should be interpreted with caution and must relate to relevant clinical findings.

Non-Operative Management

The author did not find any prospective studies analyzing the efficacy of nonoperative treatment of abductor tears after THA during our literature review. Some surgeons prefer to try all patients with abductor tear or weakness on a trial of conservative management especially those with suspected superior gluteal nerve damage. Spontaneous recovery is reported in up to 95% of patients with superior gluteal nerve palsy by 24 months after THR [35]. Serial EMG can be used in the diagnosis and to assess recovery in these patients.



Fig-2: Illustration demonstrating the typical site abductor tendon defects

Surgical Management

Patients with abductor tear who failed the trial of conservative management with persistence of pain and limb should be considered for surgical management. Different surgical techniques of abductor repair have been described in the literature with mixed and varying degree of outcome results. In a series of 9 patients treated with open repair with non-absorbable sutures through drill hole, Weber and Barry reported modest improvement in limp (five of nine improved) and use of walking support (six used no support). However, only one of five patients with moderate or severe pain was improved with mean follow up of 5 years [26]. Miozzari evaluated the results of late repair of abductor avulsion in 12 patients who underwent THA via the transgluteal approach. The repair was done with transosseus non absorbable sutures. All 12 had MRI pre and post operatively. At 1-year follow-up, 9 of the 12 patients were satisfied with the result and had improved pain scores. However, four patients had a persistent limp at 1 year follow up. Postoperative MRI examination demonstrated an intact repair in six patients and failure in four [36]. A pooled cohort of 40 patients undergoing transosseous repair reported by Odak and Ivory where 16 patients had no limp, 13 had mild to moderate limp and 11 reported severe limp post-operatively [10]. In terms of pain, it was measured post operatively in several studies. In one study of 12 patients treated with direct interosseous repair, all the patients reported an improvement of pain with no further details [36]. Another pooled cohort of 34 patients from three studies, where 27 treated with transosseous repair and seven with Achilles tendon allograft reconstruction showed that 23 had no or mild pain post-operatively, nine had moderate pain and two had persistently severe pain [10]. For chronic abductor deficiency, several surgical reconstruction techniques have been described. Fehm et al. [11] used a freshfrozen Achilles tendon with attached calcaneal bone block allograft to reconstruct the deficient abductor. In his series of 7 patients who were treated with technique between 2003 and 2006, 6 had substantial improvements in both the Harris hip score and the pain score after a minimum duration of follow-up of twentyfour months. He concluded that this technique could produce substantial relief of pain, increased abductor muscle strength, decreased limp, and improvements in the Trendelenburg sign and in function at the time of early follow-up. Another technique was described by Whiteside [37] where the anterior half of the gluteus maximus was transferred to the greater trochanter and sutured under the vastus lateralis then a separate posterior flap was transferred under the primary flap to substitute for the gluteus minimus and capsule. The technique was performed in 11 patients with complete loss of abductor attachment with mean follow up of 33 months. 9 patients had strong abduction of the hip against gravity, no abductor lurch, and negative Trendelenburg sign while 1 patient had weak abduction with negative Trendelenburg sign and 1 patient failed to achieve strong abduction and had severe limp. Another paper described the technique of using Vastus lateralis to reconstruct deficient abductor in THA. In this technique, the vastus lateralis (VL) muscle was raised on its neurovascular pedicle and transferred by proximal translation. The proximal portion of VL was reattached via bony anchors to the external surface of the iliac wing just below the iliac crest. The distal portion of VL reattached to the lateral femoral shaft, lateral intermuscular septum, and the fascia of vastus intermedius. Wang reported that 3 of the four patients included in this series reported dramatic improvement in pain and reported being "extremely satisfied" with the operation overall. Two patients reported being "extremely satisfied" with improvements in walking. Hip abduction power improved in all patients but to varying degrees at an average follow-up of 10 months. (Table 1) summarizes the studies associated with chronic abductor insufficiency reconstruction.

Table-1: Summary of Studies Associated with Chronic Adductor Insufficiency Reconstruction			
Characteristics	Fehm <i>et al.</i> (4)	Whiteside (5)	Wang (6)
Year of publication	2010	2012	2014
No. of patients	7	11	4
Reconstruction Method	fresh-frozen Achilles	Gluteus Maximus	Vastus Lateralis
	Tendon Allograft	Tendon Transfer	Tendon Transfer
Mean Age	73	67	69

16 months

24 months

Table-I: Summary of Studies Associated with Chronic Abductor Insufficiency Reconstruction

IV. CONCLUSION

Mean

follow-up

Tear of the abductor mechanism (i.e., rotator cuff tear of the hip) is a known cause of hip pain following THA. However, it should be considered in all patients, particularly older women, with lateral hip pain and abductor weakness that are unresponsive to nonsurgical management. Evaluation of hip abductor weakness after THA should incorporate a clinical history, examination including a Trendelenburg test, and a review of plain radiographs. MRI remains the diagnostic modality of choice when assessing this problem and has great diagnostic sensitivity and specificity. Contrary to the general belief, there is no clear evidence that the incidence of abductor weakness or tear is higher in lateral or anterolateral approaches than posterior approaches. Repair of the torn abductor tendons typically provides good pain relief as well as improved strength and function. Small series have reported promising results following reconstruction of the abductor tendon complex with a gluteus maximus muscle flap or an Achilles tendon allograft or vastus lateralis transfer in short term follow-ups but still lack the long-term results.

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