

SYSTEMATIC REVIEW

Role of Hip Arthroscopy in the Treatment of Avascular Necrosis of the Hip: A Systematic Review

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Abstract

Background: Avascular necrosis (AVN) or osteonecrosis of the femoral head occurs as a result of a vascular supply disruption that could lead to hip osteoarthritis. Recently, several joint-preserving procedures have been suggested to improve the outcome of AVN, including hip arthroscopy. This systematic review aimed to investigate the role of hip arthroscopy to preserve hip joints suffering from AVN.

Methods: This review was conducted to collect data on hip arthroscopy from the available literature for the management of AVN. The collected articles included those that were focused mainly on the management of AVN assisted by arthroscopy and published up to 2020 that were searched in four databases using such keywords as “Avascular Necrosis”, “AVN”, and “Osteonecrosis” in combination with “Hip Arthroscopy” or “Arthroscopic Hip Surgery”.

Results: In total, 13 articles met the eligibility criteria, and no severe complications were reported after arthroscopy in patients with AVN. Moreover, the Harris scores were higher than 79 after the operation. The majority of the assessments showed that the use of arthroscopy was effective in the diagnosis and treatment of patients with AVN, except for one study, which had been performed on patients with stage IV AVN.

Conclusion: The findings supported the idea that hip arthroscopy is effective in the treatment of AVN. This approach is becoming more popular for the diagnosis and treatment of hip disorders.

Level of evidence: I

Keywords: Avascular necrosis of femoral head, Hip arthroscopy, Ischemic bone necrosis, Osteonecrosis

Introduction

Avascular necrosis (AVN) of the femoral head is a menacing disease in which the decreased blood flow to the femoral head leads to the death of bone cells and can result in articular surface collapse, and consequently, osteoarthritis (1, 2). Alcoholism, steroid use, unapproved weight gain medications, and hip trauma are the main causes of this condition (3-7). The pathogenesis of the avascular necrosis of the femoral head (AVNFH) is not well known (8).

Since AVNFH usually affects younger individuals (4, 9), it is of utmost importance to implement an early intervention to save the femoral head (FH) and prevent further arthritic changes (8). Several joint-preserving procedures have been recommended for the treatment of AVNFH. Some of these procedures, including core decompression with or without bone graft, aimed to prevent the collapse of the FH (10). Other procedures, such as trap door operation (2), focused

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on the restoration of the collapsed bone to support the cartilage. Rotational osteotomies with the goal to redirect the diseased bone from the weight-bearing area are the other type of joint preserving procedures (2). However, there have been no standard protocols for the treatment of AVNFB to retain the patient's native hip joint (10, 11).

The majority of the hip preserving procedures are performed through open hip surgery, which is more or less associated with morbidity and risks. The role of hip arthroscopy in the diagnosis and treatment of AVNFB has been described in recent years (10). The present study aimed to review the current evidence on the therapeutic and diagnostic role of arthroscopy in patients with AVNFB.

Materials and Methods

A comprehensive search strategy was utilized to collect data based on the Cochrane Handbook for systematic reviews. Furthermore, the main stages in this study included the selection of eligibility criteria, searching databases, removal of unrelated articles, quality assessment, data extraction, and evaluation of the gathered data (12). It is worth mentioning that all published papers up to 15 October 2019 were searched in Google Scholar, PubMed, Scopus, and Medline databases.

Eligibility Criteria

A Participants-Intervention-Comparison-Outcome-Study design was utilized to select the eligibility criteria for this study. The inclusion criteria included 1) a clear description of the diagnostic and therapeutic role of the hip arthroscopy in patients with AVN of the hip, 2) sufficiency of the data, 3) sample size higher than 10 patients, and 4) investigations on human samples. On the other hand, *in vitro* and animal studies, non-clinical research, review articles, meta-analyses, expert opinions, editorial letters, case reports or case series, consensus statements, and qualitative investigations were excluded from the review process. In addition, the articles that were focused on the other therapeutic approaches or patients who underwent arthroplasty were removed from the study. In this study, even the non-randomized, non-blinded, and retrospective studies were included due to the dearth of the randomized clinical trial studies. Therefore, all case-control, prospective, and retrospective studies performed on human subjects were included to assess the role of hip arthroscopy in patients with AVN. In addition, the studies assessing the diagnostic and therapeutic role of hip arthroscopy in other diseases were excluded from the current study.

Literature Search

The search process was conducted in four electronic databases, including Google Scholar, PubMed, Scopus, and Medline up to March 2020. Moreover, the keywords that were used to accomplish the search process included "Avascular Necrosis", "AVN", and "Osteonecrosis", in combination with "Hip Arthroscopy" or "Arthroscopic Hip Surgery".

Study Selection, Data Extraction, and Study Design

This systematic review focused on the studies with an emphasis on the diagnostic and therapeutic role of hip arthroscopy in patients with AVN of the hip. The search process was carried out using the selected keywords and searching in four electronic databases, including Google Scholar, PubMed, Scopus, and Medline, up to March 2020. In the next step, the number of papers in each database was determined, and the titles and abstracts were then reviewed and screened for relevancy. The selection process was performed based on consistency with the eligibility criteria. In the screening stage, the articles inconsistent with the study objectives were removed after reviewing the title and abstract of each article. Subsequently, the full-text version of the selected articles was obtained for final screening. It should be mentioned that two researchers separately reviewed the titles and abstracts of all articles and were continuously in contact with each other to consult and exchange the required information. Furthermore, they discussed the results obtained from papers and determined the eligibility criteria with mutual agreement. Following that, the researchers extracted the information related to the study objectives and recorded them in a researcher-made form. Figure 1 depicts a PRISMA flow diagram presenting the stages of the paper selection.

Risk of Bias and Quality Assessment

Based on Cochrane's risk of bias tool, the risk of bias in the included studies was assessed in eight domains, including bias due to confounders, selection of participants, measurement of intervention, missing data, selective reporting, measurement outcome, departure from intended intervention, and other sources (13).

Results

In total, 824 articles were found in the first search, out of which 628 papers were excluded due to irrelevancy, and a total of 196 articles remained after the primary investigation. Another 34 articles were removed from the study since they were duplicates. Furthermore, the articles investigating other hip joint diseases than AVN were excluded from this study (n=51). Other excluded studies were experimental or *in vitro* articles (n=0), studies just reporting a technique (n=16), studies assessing the complication of arthroscopy in patients with hip joints problems (n=19), studies with a sample size of fewer than 10 people (n=6), editorial letters (n=1), books (n=2), narrative articles and reviews (n=31), and case reports (n=23). Eventually, 13 articles remained to be included in this review [Figure 1].

No randomized double-blind clinical trials were found in this study. Accordingly, only pre-and post-intervention, as well as comparative studies were included in this review. The included studies were performed in five different regions, the most frequent (53.8%) of which were China (n=7). Moreover, three studies were conducted in European countries, including Germany (n=1), Switzerland (n=1), and Poland (n=1). A total of three (23%) studies were carried out in the USA, and no study was found to be conducted in South

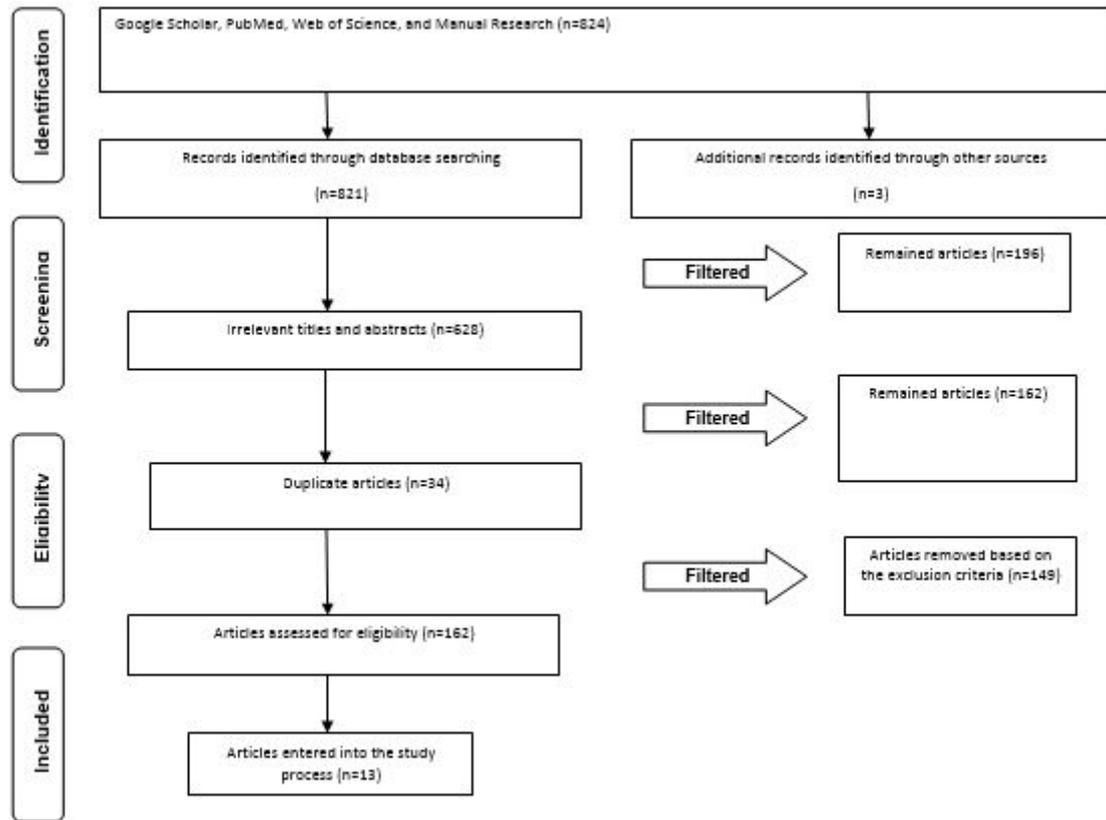


Figure 1. PRISMA flowchart representing the study selection process.

America and Africa. The included studies (n=13) were performed on 799 patients (895 hips) with AVN (stages I-III). The mean age of the patients was 44 years, and the majority of the studies included more males than female patients. No severe complications were reported after arthroscopy in the patients with AVN, and Harris scores were higher than 79 after arthroscopy. The mean follow-up duration after operation ranged from 12 months to 2.5 years. Furthermore, multiple small-diameter drilling decompression combined with arthroscopy was utilized in some studies (10, 14, 15).

Arthroscopic core decompression combined with autogenous cancellous bone graft and bone morphogenetic protein was applied in a study conducted by Zhuo et al. (16). The patients in a study performed by Guo et al. underwent drilling decompression with a 3.5-mm Steinmann pin under the C-arm X-ray monitoring. Synovectomy and cartilage trimming were performed through hip arthroscopy combined with hip arthrosynovitis or cartilage trauma (17). This was similar to the method adopted by Sekiya et al. (18)

Ellenrieder et al. performed core decompression using a guiding sleeve via a lateral approach. In this technique, a central drill hole was used to curettage the necrotic area through the insertion of the autogenous bone cylinders (19). Similarly, multihole decompression and arthroscopic debridement were performed in a study

conducted by Xue-Zhong et al. (20). The arthroscopy procedures in a study carried out by Liu et al. consisted of the removal of loose bodies, debridement, and biopsy (21). In a study performed by Majewski et al., an incision was placed 2 cm ventral and caudal to the greater trochanter. Moreover, the joint was filled with 10-20 ml Ringer's Lactate solution over a puncture needle providing enough joint space to pass the blunt trocar without traction (22).

The majority of the studies showed the effectiveness of arthroscopy in the diagnosis and treatment of patients with AVN, except for one article, which was performed on patients with stage IV of AVN.

Table 1 tabulates the data extracted from each study including time and place of the study, sample size, age, male to female ratio, stages of AVN, complications after arthroscopy, follow-up, and outcomes (23).

Determination of the Risk of Bias

In total, 13 articles were carefully reviewed in this study considering the risk of bias in eight domains, and Cochrane guidelines were followed to assess the quality of the included studies. To assess the risk of bias, low and high risks of bias were marked as "Yes" and "No", respectively. Moreover, unclear or unknown risk of bias was specified as "Unclear". Figure 2 illustrates the quality assessment of the selected articles.

Table 1. Data extracted from each included study

Authors (years) Reference	Country	Type of study	Sample size	Group	Age	Female/ Male	Stage	Complication	Harris scores after operation	Follow-up	Outcome
Li et al. (2017) (5)	China	Retrospective analysis	60 patients (98 hips)	A ¹ :26 cases/43 hips B ² : 34 cases/55 hips	A:37.4 B:35.2	A:15/11 B:18/16	Early-stage (I and II stage)	No sever complication	A:82.07 B:75.79 P<0.005	57.6 months	Drilling decompression combined with hip arthroscopy is effective in the treatment of patients with early-stage of AVNFB
Li et al. (2017) (8)	China	Prospective, Case-control	91 patients (127hip)	HA: 39 cases/53 hips C:52 cases/74 hips	Two groups were matched	Two groups were matched	Early-stage	Temporary sciatic nerve apraxia during operation in 2 cases	HA:83.3 C: 76.61 P<0.005	HA:39 C:34	Improvement in pain relief and hip function in patients who underwent hip arthroscopy.
Guo et al. (2018) (12)	China	Prospective, Case-control	76 patients(76 hips)	HA ³ :38 C ⁴ :38	HA:43.9 C:44.6	HA ⁸ /27 C:12/29	Early-stage (stage II)	No sever complication	HA:86.72 C:78.62 P<0.005	30 months	Using the arthroscopic-guided core decompression method can improve results in patients with AVN.
Wang et al. (2007) (9)	China	Prospective, Before-after	226 patients (383 hips),	--	36.5	57/169	--	Progress in the staging of clinical course and collapse of the femoral head in patients with low Harris scores and Hydrops articuli.	Before operation:68 After: 79 P<0.005	35 months	Excellent curative effect was found in the majority of hips. The AVNFB was improved by hip arthroscopy through scavenging pain-producing substances, removing the cartilage chips caused by isolation or undermining dissection, and correcting internal environment disorder.
Ellenrieder et al. (2013) (14)	Germany	Prospective, Before-after	53 patients (56 hips)	--	44	39/14	Steinberg stages I-III	No sever complication	--	33 months	In case of cartilage defects or potential collapse of the femoral head, arthroscopy of the hip joint was performed. The success rate was reported in 86% of patients treated with Steinberg stages I-III.
Majewski et al. (2010) (17)	Switzerland	Prospective, Before after	11 patients	--	13 years	7/3	Idiopathic femur head necrosis	No iatrogenic cartilage injury, no infection, no wound-healing problem, and no neurovascular complication	--	1-year follow-up	An average increase in hip motion of flexion, abduction, adduction, external rotation, and internal rotation was reported in patients who underwent arthroscopy
XUE-ZHONG et al. (2007) (15).	China	Retrospective study	72 patients (80 hips)	HA: 41 cases/ 46 hips C:31 cases/34 hips	Two groups were matched	--	(stages 0, I, II)	No sever complication	--	--	Success rate was higher in multihole core decompression and arthroscopic debridement in the management of AVNFB, compared to the traditional group
Liu et al. (2002) (16)	China	Prospective, Before-after	16 patients with avascular necrosis	--	17 to 64 years.	33%/77%	--	No sever complication	Harris hip scores increased by 27 on average. (P<0.005)	--	The patients with avascular necrosis reported no pain after arthroscopy and the Harris hip scores increased by 27 on average

Table 1. Continued

Zhuo (2012) (11)	China	Prospective, Before-after	28 patients (33 hips)	--	1-3 years	--	--	No sever complication	85.67- 81.33	followed up 2.5 years	Better results in patients who underwent arthroscopic core decompression combined with autogenous cancellous bone graft and BMP compared to traditional closed core decompression in terms of pain and hip function improvement, as well as slowing down the process of femoral head necrosis
Przybył et al (2017) (18)	Poland	Prospective, Before-after	14 patients (14 hips)	--	--	--	--	No sever complication	--	12 months	A good outcome was reported in the arthroscopic treatment of avascular necrosis produced at 6 and 12 months after the surgery.
O'Leary et al. (2001) (10)	USA	Retrospective	83 patients (86 hips)	--	29.2	37%/67%	--	No sever complication	--	30 months	Improvement was reported in only 40% of AVN patients over 30 months.
Sekiya et al (2000) (13)	USA	Prospective study	23 hips	--	--	--	--	--	--	--	A weak correlation was observed among the results obtained from plain radiographs, magnetic resonance imaging, and arthroscopy, indicating poor correlation among the current imaging techniques in terms of the staging of AVN.
Ruch et al. (2001) (19)	USA	Prospective study	46 patients (52 hips)	--	--	--	--	--	--	--	Based on the obtained results, arthroscopy of the hip was a success in a diagnosis of osteochondral degeneration that was not detected by plain radiographs or magnetic resonance imaging.

Table 2. Quality assessment of the studies included in the review

Authors (years) Reference	Bias due to confounders	Bias due to the selection of participants	Bias due to the measurement of intervention	Bias due to missing data	Incomplete outcome data	Free of selective reporting	Other sources of bias
Li et al. (7)	Yes	Yes	Yes	Yes	Yes	No	Yes
Li et al. (11)	No	No	No	No	No	Unclear	No
Guo et al. (14)	No	No	No	Yes	No	Yes	No
Wang et al. (12)	No	No	Yes	Yes	Yes	Unclear	Yes
Ellenrieder et al. (16)	No	No	No	No	No	Yes	No
Majewski et al. (19)	No	No	No	No	No	No	No
Xue-Zhong et al. (17)	Yes	Yes	No	No	No	No	Yes
Liu et al. (18)	No	No	No	No	No	Yes	Unclear
Zhuo et al. (13)	No	No	No	No	No	Yes	No
Przybył et al. (47)	Yes	No	No	No	No	Yes	Unclear
O'Leary et al. (48)	Yes	Yes	Yes	Yes	No	Yes	No
Sekiya et al. (15)	No	No	No	No	No	Yes	No
Ruch et al. (30)	No	No	No	No	No	Yes	No



Figure 2. Quality assessment of the studies included in the review.

Discussion

Arthroscopic surgery of the hip is a very useful and facilitating technique in the treatment of different hip diseases. The use of hip arthroscopy in the treatment of AVN of the femoral head has been explained in different studies; however, there is no consensus on the role of arthroscopy in the diagnosis and treatment of the AVN (8). This systematic review attempted to answer three main questions based on the current literature.

Is arthroscopy beneficial in the treatment of patients with avascular necrosis of the femoral head?

The reviewed literature showed the beneficial effect of arthroscopy on patients with AVN of the femoral head. Ellenrieder et al. showed the improvement of the hip function following hip arthroscopy for AVN in 86% of patients with stages I-III of AVN (19). In a study performed by Majewski et al., arthroscopy in patients with AVN led to an average increase in hip motion (flexion, abduction, adduction, external rotation, and internal rotation) (22). In the same line, Wang et al. conducted a study on 226 patients with AVN (383 hips). Based on the obtained results, the Harris score was significantly increased after the operation, and excellent and medium curative effects were found in 69.5% (Harris score > 80) and 24.5% (Harris score between 70 and 79) of the hips, respectively. However, only 6% of the patients experienced poor results (Harris score < 69). Lie et al. showed that hip arthroscopy and decompression were associated with an improvement in pain and hip range of movement and function in six months (10). Similarly, Guo et al. conducted a study to evaluate the effects of arthroscopy-guided core decompression and bone grafting on 76 patients with early-stage AVN (i.e., stage II). According to their results, the patients who underwent arthroscopy obtained better imaging outcomes and higher Harris hip scores, compared to the control group (17).

The AVN was improved by hip arthroscopy through scavenging pain-producing substances, removing the

cartilage chips caused by isolation or undermining dissection, and correcting internal environment disorder (15). In the same line, Liu et al. performed a study to determine the diagnostic and therapeutic value of arthroscopy in 16 patients with AVN. In this study, the arthroscopic procedure consisted of the removal of loose bodies, debridement, and biopsy. An average increase was reported in the Harris hip scores (27 points), and patients had no pain after arthroscopy (21).

Several arthroscopic procedures have been described for the retreatment of patients with AVN of the femoral head. Trapdoor and light bulb approaches are among the two most common open surgeries (24, 25). These approaches can be used as a predictable preservation technique in the pre-collapse stage. Muscular preservation, decreased recovery times, as well as reduced postoperative pain and infection are the main advantages of the light bulb as an arthroscopic surgery technique, compared to open procedures (26). Based on the results of a study conducted by Rosenwaser et al., the light bulb approach and autologous iliac bone grafting had a high rate of clinical success (25). Additionally, the light bulb approach was utilized in a study conducted by Wang et al., and the survival rate was estimated to be 85% in patients with stage IIA and IIB of AVN. Moreover, the corresponding value was determined at 60% in patients with stage IIIA and IIC of AVN (27).

Other studies described arthroscopic procedures for decompression. Li et al. evaluated the effectiveness of multiple small-diameter drilling decompression combined with hip arthroscopy in the treatment of patients with AVN of the femoral head. Based on the obtained results, the patients who underwent hip arthroscopy and decompression obtained higher Harris scores, compared to those who underwent drilling decompression alone. They showed hip arthroscopy as an effective technique in the treatment of patients with early-stage AVN of the femoral head, and no serious complications were reported during follow-ups. These findings were consistent with the results

of another study performed by Li et al. which revealed that hip arthroscopy was effective in slowing down the process of femoral head necrosis and delaying the need for total hip arthroplasty in patients with AVN (14).

Guadilla et al. indicated the viability of the core decompression and bone grafting in the treatment of patients with AVN. This approach helps avoid open surgery in these patients (26). In a study performed by Xue-Zhong et al., the effectiveness of multi-hole core decompression and arthroscopic debridement was investigated in the management of AVN. The results revealed that the group who underwent the modified techniques obtained a higher success rate (86.9%), compared to the group who underwent traditional treatment (58.8%) (20).

In another study carried out by Zhuo et al., 28 patients (33 hips) with early-stage AVN underwent arthroscopic minimally invasive surgery (i.e., arthroscopic core decompression) to determine the effectiveness of this management technique. It should be noted that arthroscopy was combined with autogenous cancellous bone graft and bone morphogenetic protein or simply closed core decompression. The obtained results indicated pain relief and improved hip function in all patients after six months. Additionally, the mean Harris score of the patients who underwent arthroscopy combined with autogenous cancellous bone graft was 85.67. Moreover, those who underwent arthroscopy utilizing bone morphogenetic protein or simply closed core decompression obtained a score of 81.33. Improvement in pain and hip function, as well as delays in the process of femoral head necrosis, was observed in patients who underwent arthroscopic core decompression combined with autogenous cancellous bone graft and bone morphogenetic protein, compared to those who underwent traditional closed core decompression (16).

The included studies in this review confirmed the effectiveness of arthroscopy in the treatment of patients with early-stage AVN; however, as anticipated, this procedure failed to show beneficial effects on patients with advanced AVN.

The AVN is not only a bone disease, it also involves the hip joint in the process. Therefore, the secondary pathological changes in the hip joint should be considered in addition to the decompression of the FH for the treatment of AVN (10). Regardless of the causative factors, such as idiopathic conditions, high-stress trauma, high-dose corticosteroid administration, or alcohol abuse, the treatment of AVN includes the activation of the biological process, which is dictated by the disease stage and size of the lesion (28). Li et al. showed less joint effusion in patients with stage I AVN, whereas this condition appears in stage II AVN (10). The management of early-stage AVN is of utmost importance, and multiple small-diameter drilling decompression combined with hip arthroscopy is a comprehensive therapy for these patients. Based on a study conducted by Li et al., hip arthroscopy is used to directly visualize the condition of the joint and remove synovial hypertrophy. They eliminated the agents

causing inflammation by rinsing with physiological saline solution (10), which decreased the intra-articular pressure and improved the functions of the joint as well as its internal environment (29). Moreover, it led to the recovery of joint activity and blocked the vicious inflammatory cycle (30). According to some studies, the rate of penetrating cartilage can be decreased by arthroscopy (31-34).

The main indicators for using hip arthroscopy in the treatment of patients with early-stage AVN include failures in conservative treatment, remarkable synovial hyperplasia, effusion, and articular cartilage damage diagnosed by magnetic resonance imaging (MRI), as well as corpus liberum in the articular cavity or labrum injury with mechanical symptoms (10).

Is arthroscopy an applicable diagnostic approach for the management of patients with avascular necrosis?

The choice of treatment for AVN depends on MRI and radiography outcomes (28). Although plain radiographs and MRI images are commonly used to diagnose and determine the stages of AVN, they are not appropriate approaches to diagnose early articular cartilage damage (35, 36). The results confirmed the advantages of arthroscopy for the diagnosis of AVN, compared to MRI and radiography. In total, two studies made a comparison between the diagnostic value of arthroscopy and other techniques, such as MRI (18, 33).

Ruch et al. conducted a study to evaluate the correlation between plain radiographs, MRI, and diagnostic arthroscopy in the staging of the AVN. A moderate correlation was reported between MRI and plain radiographs, MRI and arthroscopy, as well as plain radiographs and arthroscopy in this study.

Based on the obtained results, the arthroscopy efficiently diagnosed the osteochondral degeneration that was not detected by plain radiographs or MRI (18). In another study carried out by Sekiya et al., the diagnostic accuracy of the hip arthroscopy was evaluated in patients with AVN. They showed a weak correlation among the results obtained from plain radiographs, MRI, and arthroscopy. Accordingly, a poor correlation was reported among the findings of the current imaging techniques in terms of the staging of AVN. Due to the insufficiency of MRI in assessing the articular cartilage, arthroscopy is required for accurate evaluation and staging, especially in patients in advanced stages of AVN (33).

The MRI findings on the articular cartilage of the hip joint during traction were compared with the arthroscopic results in a study conducted by Nakanishi et al. The obtained results indicated that MRI outcomes corresponded well with the arthroscopic findings of all cases suffering from osteonecrosis and advanced osteonecrosis (37). However, this study was not entered in this review due to the small sample size (i.e., fewer than 10 patients).

Hip arthroscopy is considered a gold standard for the diagnosis of intra-articular hip pathology (38). Based on one study performed by Sekiya et al., only 36% of the damage observed by hip arthroscopy can be diagnosed by MRI (18). Hip arthroscopy offers some advantages,

compared to other techniques. Direct observation and size determination of the damaged articular surface is possible by this approach (33). Moreover, this technique can be used to determine the stage of this disease (18). The hip arthroscopy is more accurate in pathology diagnosis, with no evidence in MRI or plain radiography. This technique is useful in the identification of patients with remarkable joint damage who might not benefit from core decompression (26, 39).

Arthroscopy is associated with substantial increases in both diagnostic sensitivity and accuracy in drilling the necrotic area compared with conventional open surgery. Moreover, specificity in determining the condition of cartilage and labrum facilitates intra-operative decisions regarding further treatments (30).

Is arthroscopy a safe approach in the treatment of patients with avascular necrosis?

Based on several studies, the development of AVN is one of the postoperative complications following hip arthroscopy caused by excessive traction weight and time (40). Therefore, it is necessary to select a safer mid-anterior or anterolateral surgical approach to decrease the level of damage to the femoral artery and femoral nerve (18). Similarly, the traction weight and time should be taken into account to prevent injury to the perineal area during hip arthroscopy (41). Due to the relationship between the outcome of core decompression surgery and the time of postoperative non-weight bearing, it is necessary to develop a rehabilitation training program after hip arthroscopy to enhance hip function (42). Rupp et al. performed a study to determine the risk of AVN after arthroscopic femoroplasty extending to the posterolateral femoral neck. No evidence of AVN has been observed in patients who underwent MRI evaluation after femoroplasty. Due to the lack of association between avascular necrosis and femoroplasty of the posterolateral vascular region of the FH, arthroscopic posterolateral femoroplasty can be used in these patients without worries about the incidence of AVN (43). This finding was confirmed in another study conducted by Christopher et al., which was performed to assess the complications in patients who underwent hip arthroscopy. Cases with AVN after hip arthroscopy have been rare to date (44). Based on one study conducted by Chan et al., only one case with AVN was reported in 530 hips that underwent arthroscopy (45).

It is of significant importance to choose an appropriate treatment for AVN (34, 46). Based on the obtained results of the included articles in this study, no severe complication was observed among patients with AVN who underwent arthroscopy. However, Wang et al. reported progress in the staging of clinical course and collapse of the FH in patients with low Harris scores and hydrops articuli (15). Moreover, Li et al. revealed temporary sciatic nerve apraxia during operation in 2 out of 91 patients with AVN who underwent arthroscopy (14).

One of the main advantages of hip arthroscopy is

the safety of the technique. However, this method is accompanied by post-operative complications (47), most of which are injury to perineal skin, nerve palsy, vascular injury, compartment syndrome, hematoma, and infection which are observed in 4% of the hip arthroscopy surgeries (48, 49). Several studies assessed the risk of arthroscopy and post-operative complication of this approach in patients with AVN. Since the mentioned studies did not meet the eligibility criteria, a summary of this issue was reported in this review.

Arthroscopy can be used as an adjunct procedure in patients with early-stage AVN for both diagnostic and therapeutic purposes. The utilization of hip arthroscopy in patients with AVN allows the surgeon to make a better diagnosis and develop a proper treatment. It also makes it possible for the surgeon to treat intra-articular pathology associated with AVN and perform head-preserving surgical procedures, such as core decompression with or without bone grafting or light bulb operation in a less invasive manner.

Suggestion and Limitations

Some interfering factors, such as age, associated comorbidities, and surgeon experience are considered among the affecting factors. The majority of the articles in this review included patients in the same age groups; however, all interference variables were not assessed, which might affect the obtained results of the reviewed studies. Therefore, it is suggested that future studies assess the therapeutic and diagnostic role of arthroscopy among patients with AVN in different stages considering possible confounding variables. Moreover, due to the lack of homogeneity in the studies to assess the hypothesis, some studies were retrospective in nature, which could affect the outcomes in this study.

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Conflict of interest: The authors declare that they have no conflict of interest regarding the publication of this study.

Disclaimer: It should be noted that the present study is informational; therefore, the described strategies might not be suitable for other conditions or purposes.

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