SYSTEMATIC REVIEW

Outcomes and Complications of Arthroscopic Treatment for Septic Arthritis of the Hip: A Systematic Review

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Abstract

Objectives: The exact role and safety of arthroscopy in SAH management remain contentious. This systematic review aims to assess the outcomes and complications of arthroscopic treatment, shedding light on its efficacy and safety profile.

Methods: Following PRISMA guidelines, searches were conducted in PubMed, Scopus, Embase, and Web of Science until January 25, 2024. Eligible studies included SAH patients undergoing arthroscopic treatment. Data extraction covered demographics, clinical findings, and functional outcomes. Quality assessment used NIH case series assessment and Newcastle-Ottawa Scale. Quantitative analysis focused on Hip Harris Score, post-operative pain rate, and revision rate using a random-effects model. Comprehensive Meta-Analysis (CMA) software version 3.3 facilitated analyses.

Results: The primary search yielded 1,662 articles, after screening the records, 35 study included. In case report studies, 18 patients were analyzed with an average age of 33.7 years. Complications included joint ankylosis, osteonecrosis, muscle atrophy, and osteopenia. Revision surgery was performed in three cases, with one due to infection. In case series studies, 295 patients with an average age of 15.6 years had complications such as joint collapse, femoral nerve palsy, and avascular necrosis. Thirteen revision cases were reported. Among 18 case series, arthroscopic complications were noted in nine studies, while six studies reported none. Full range of motion was achieved in 13 studies, and pain resolution in 11.

Conclusion: Utilizing arthroscopic techniques for treating septic arthritis of the hip represents a safe, effective, and minimally invasive choice, demonstrating favorable clinical results, relatively low rates of revision and complications, and rapid rehabilitation periods.

Level of evidence: IV

Keywords: Arthroscopy, Hip, Hip infection, Septic arthritis

Introduction

Septic arthritis of the hip (SAH) is considered an orthopedic emergency due to its potential for serious complications.[1] These complications include soft tissue injury, abscess formation, cartilage destruction, chronic osteomyelitis, avascular necrosis, hip ankylosis, and systemic sepsis.[2-6] Approximately one-third of SAH patients experience morbidity.[7] Cartilage destruction can begin within 24 hours of infection, and delayed treatment may lead to osteomyelitis after 10 days.[8] Therefore, Swift intervention, including septic joint decompression and antibiotic therapy, is crucial for successful outcomes with minimal long-term effects.[9]

A variety of treatment options are available such as, management strategies have ranged from arthrocentesis to invasive open arthrotomy or even arthroplasty.[10-16] there is no clear guideline or algorithm for selection the treatment

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options.[10,11] Open arthrotomy debridement and washout is considered the standard treatment for SAH, however this procedure is an invasive method and it may result in some serious sequela such as avascular necrosis and post operative hip instability.[17-19] In recent decades arthroscopic hip irrigation and debridement have demonstrated relative efficacy in infection eradication in both pediatric and adult populations, additionally this minimally invasive approach promises several advantages, including reduced recovery times and potentially lower complication rates, however exact indications and safety profile remains a subject of debate.[10, 20-22]

In this systematic review, we delve into the body of literature surrounding arthroscopic management of SAH. Our primary objective is to critically analyze the outcomes and complications associated with this treatment modality, thereby providing a comprehensive overview of its effectiveness and safety.

Materials and Methods

This study is implemented according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement. The protocol of this systematic review is registered in PROSPERO (42022381376).

Search Strategy

Pubmed, Scopus, Embase and Web of Science were searched without date restriction until 25 January 2024. An additional citation chasing strategy was performed to decrease the possibility of missing articles to the minimum.[23] The following search strategy was used to search in title and abstract in both searching phases: (Hip OR "Hip Joint") AND (Arthroscopy OR arthroscopy*) AND (infect* OR suppurative OR septic).

Eligibility Criteria

Studies that comprised Patients who suffered from SAH and underwent arthroscopic treatment were included without restricting age and gender.

Studies other than clinical studies (reviews, news, letters, editorials, conference abstracts, surgical protocols, unpublished manuscripts, and book chapters) and studies with a lack of information including unconvertible or non-extractable data were excluded.

Study Selection

The entire selection process was facilitated by Endnote X8 (Clarivate Analytics, Philadelphia). The initial phase involved a thorough examination of titles and abstracts by two independent reviewers (AS, SA), ensuring an unbiased review. The subsequent phase entailed a detailed analysis of the full texts, focusing on identifying the most relevant articles that align with our research criteria. During the selection process, any discrepancies between reviewers were resolved through constructive discussions, and if necessary, the final decision was made through the consensus of the third author (MP).

Data extraction

Data including patients' demographics, clinical findings, and functional outcomes was extracted using an excel spreadsheet by two independent authors (AS, SA). At last, the extracted data was cleaned and all the disagreements were resolved by a single author based on the categories explicated above.

Quality assessment

National Institutes of Health (NIH) case series assessment tool was used to assess the quality of included case series. Newcastle-Ottawa Scale (NOS) assessment tool for cohort was applied for comparative studies. Two authors (AS, SA) assessed the quality of case series and comparative studies independently, and any conflicts were resolved by a third author (MP).

Data Synthesis

For quantitative data synthesis, we focused on key outcomes such as Harris Hip Score (HHS), post-operative pain rates, and revision rates. A random-effects model was employed to account for heterogeneity across studies, using Comprehensive Meta-Analysis (CMA) software version 3.3. Heterogeneity was evaluated through the I^2 statistic, with values above 50% indicating substantial heterogeneity. In cases of significant heterogeneity, meta-regression was planned to explore potential sources of variation. Publication bias was assessed using Egger's test. Pooled estimates were presented with 95% confidence intervals (CI), and results were considered significant at $p < 0.05$.

Results

Study Selection

The primary search resulted in 1,662 articles. Of these 1,662 articles, 200 ones were primarily excluded by. The citation chasing strategy added 1,736 articles, all of which were screened based on title and abstract. Altogether, 3,198 articles were screened in two phases. Finally, 35 studies were taken for data extraction. Screening process is shown in detail [Figure 1].

Study characteristics

Our final included articles consisted of 4 comparative cohort studies, 18 case-series, and 13 case reports [Table1]. Of the 22 other studies excluding case reports, 11 were in the pediatrics field, 7 adults and 3 included both pediatrics and adults. One study did not clear out the population type [Table 2 and 3]. Supine position was used in 16 studies, lateral decubitus in two studies and 17 studies did not report position of patient during arthroscopic procedure. Drainage at the surgical site was applied in 21 studies, 9 studies did not use drainage and five studies did not present the data. Two or three portals were applied in 20 studies, eight studies reported use of a single portal and one study reported use of four portals. Almost all included studies reported no drop-outs during their follow-up period. The mean follow-up duration was 21.8 which ranged between 1 and 59 months.

Quality assessment results

Of the 18 case-series, six were assessed good, eight fair, and four assessed poor. Three out of four comparative studies were assessed good and one was assessed fair [Tables 4 and 5].

Patient characteristics and post operative outcomes

In case report studies, there were total 18 persons including 12 females and 6 males. The average age was was 33.7 ± 21.9

(mean ± SD). Complications included joint ankilosis is one, osteonecrosis in one, muscle atrophy and limping in one, and mild osteopenia in one patient. Reviosion surgery perfoemred in 3 patients which one of revisions was due to recurrent infection [Table 1].

In case series studies, there were a total 295 patients with average age was 15.6 ± 11.4 (mean ± SD). Average follow-up duration was 21.8 ± 16.5 (mean ± SD), portal numbers ranged between 2 and 4 [Tabel 2]. There were a total 13 revision cases. Complication prominatly included joint collapse, femoral nerve palsy, avascular necrosis [Table 3].

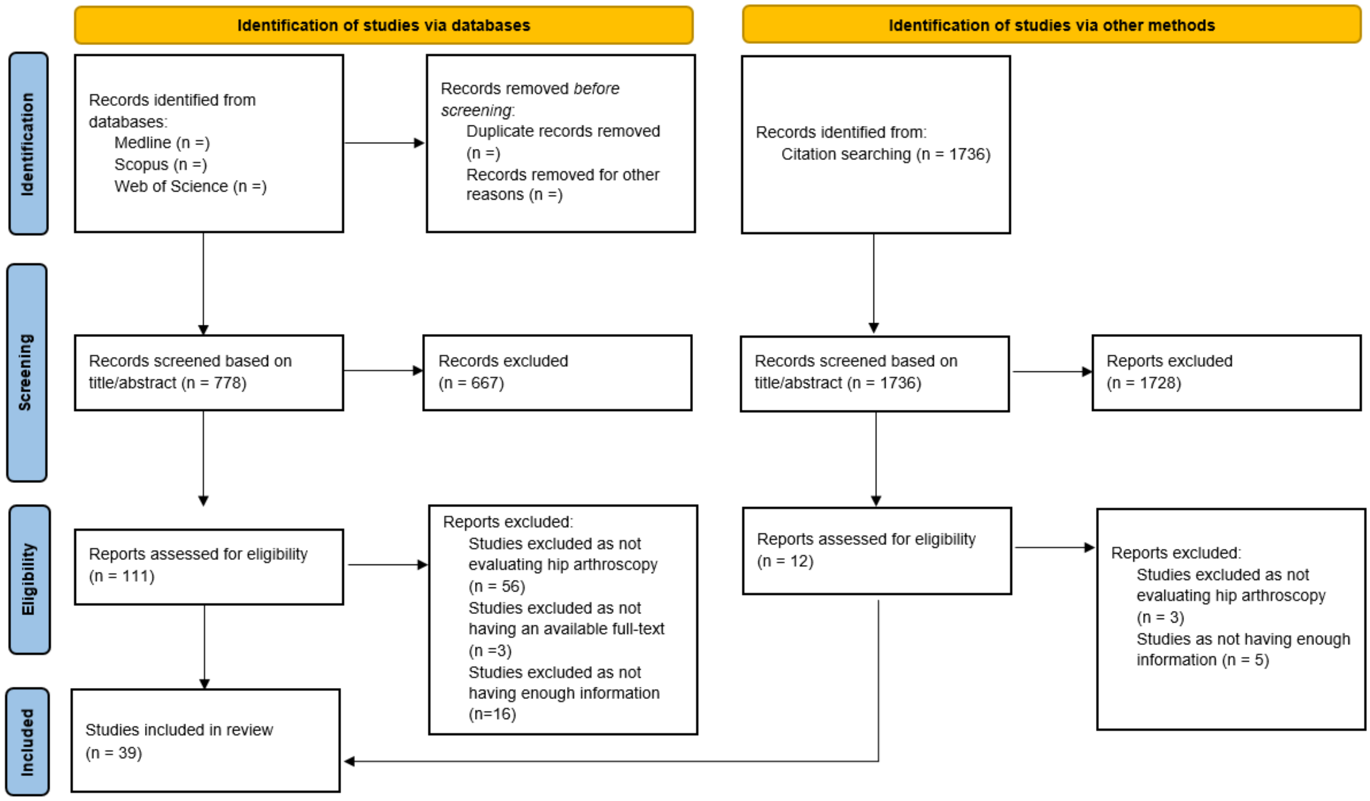

Figure 1. PRISMA Flow Diagram of Study Selection Process: This flow diagram illustrates the selection process of studies included in the systematic review

Table 1. Demographic and Postoperative outcomes of Case Reports

First author	Level of Evidence	Age (years)	Cases and gender	Cartilage Damage	Position of Patient	No of Portals	Drainage	FU (months)	Recurrency	Revision	Reason for Revision	Complications	Country
Seddigh 2020[24]	IV	24.00	1F	-	LD	3	no	6.0	yes	no	-	none	Canada
Bould 1993[25]	IV	32.00	1M	yes	-	-	yes	1.5	no	no	-	bony ankylosis	USA
Kim 2021[26]	IV	50.00, 44.00	1M 1F	-	S	3	yes	36.0, 18.0	no	no	-	none	Korea
Yamamoto 2001[27]	IV	50.00, 57.00, 46.00, 83.00	1M 3F	yes	-	3	no	31.5	no	Yes (1)	Bone deformation	none	Japan
Yoon 2015[28]	IV	49.00	1F	no	-	-	-	9.0	no	no	-	none	Korea

Table 1. Continued

Mansour 2016[29]	IV	27.00	1M	-	-	-	-	30.0	yes	Yes (1)	Pain, Infection, Inflammation	AVN	Lebanon
Haviv 2013[30]	IV	35.00	1F	no	-	3	no	18.0	no	no	-	muscle atrophy, limp	Israel
Gowda 2014 [*31]	IV	66.00	1F	-	S	2	-	6.0	no	no	-	none	USA
Jan 2020[32]	IV	7.00, 13.00	-	-	-	1	yes	15.0, 7.0	no	no	-	none	France
Walinga 2022 [33]	IV	0.04, 0.91, 0.58	1M 2F	-	-	2, 1, 1	yes	7.0	no	no	-	none	Netherland
Wong 2014[34]	IV	29.00	1F	-	-	1	no	3.0	no	no	-	mild osteopenia	China
Matsuda 2012 [35]	IV	27.00	1F	yes	S	1	yes	2.0	no	yes	FAI	none	USA
Kim 1998 [*36]	IV	8.00	1M	no	S	3	yes	24.0	no	no	-	none	Korea

S=supine, LD=lateral decubitus, FAI=femoroacetabular impingement, AVN =avascular necrosis F=female, M=male *data was extracted from a case series with only one case of SHA

Table 2. Demographic and Perioperative Data of Case Series and Comparative Studies

First author	Level of Evidence	Patient population	Age (Mean years)	Case numbers	Cartilage damage	Position of Patients	No Of Portals	Volume of Lavage (liters and type)	Drainage	Country
Nusem 2006 [19]	IV	pediatric	9.50	3M 3F	No	S	-	6 NS	no	Australia
Blitzer 1993 [37]	IV	2 adults / 3 pediatrics	33.00	2M 3F	Yes (1)	lateral decubitus	2	3 R	yes	USA
Lee 2014 [3]	IV	adult	45.00	4M 5F	-	S	3	11-15 NS	yes	Korea
Schröder 2016 [38]	IV	adult	44.00	4M 3F	No	S	4	30 NS	yes	Germany
Duman 2020 [17]	IV	pediatric	5.20	9M 6F	-	S	2	6 NS	yes	Turkey
Kim 2018 [39]	IV	adult	55.00	4M 3F	-	S	3	10-20 NS	yes	Korea
Thompson 2017[4]	IV	pediatric	60.00	5M 4F	-	-	1	3 NS	yes	USA
Kim 2003[20]	IV	2 adults / 8 pediatrics	13.00	6M 4F	-	S	3	3 NS	yes	Korea
Nusem 2012[40]	IV	2 adults / 4 pediatrics	24.00	3M 3F	-	S	3	6-8 NS	no	Australia
Sanpera 2016 [41]	IV	pediatric	6.00	12	No	S	2	-	yes	Spain
Fukushima 2021 [21]	IV	adult	46.20	5M	-	S	2	-	yes	Japan

Table 2. Continued

Danilov 2023[42]	IV	pediatric	6.04	41	No	S	2	-	yes	Germany
Eberhardt 2013[43]	IV	pediatric	-	12	No	P	2	-	-	Germany
Chung 1993[44]	IV	pediatric	4.47	5M 4F	-	S	1	0.5 NS	yes	Australia
El-Sayed 2008[45]	III	pediatric	8.00	5M 5F	No	-	2-3	-	yes	Saudi arabia
Edmonds 2018[46]	IV	pediatric	3.40	21M 26F	-	-	1	-	no	USA
Garg 2020[47]	IV	pediatric	4.30	8M 5F	-	-	1	3 NS	yes	USA
Tiwari 2015 [48*]	III	pediatric	10.18	14M 8F	Yes (22)	S	3	-	no	India
Zhou 2023 [49**]	IV	adult	37.80	5M 6F	Yes (1)	supine	3	-	yes	China
Kamiński 2007[50]	IV	adult	29.40	4M 1F	No	supine	-	10	yes	Germany
Harada 2019 [1]	III	adult	-	-	-	-	-	-	-	USA
Khazi 2020[51]	III	-	-	21M 13F	-	-	-	-	-	USA

NS=normal saline, R=ringer, M=male, F=female, *patients with tuberculosis of the hip, **patients with brucellosis of the hip

Table 3. Post-operative Data of Case Series and Comparative Studies

First author	FU (mean, month)	Recurrency	Revision (no of patients)	Revision (no of patients)	Hospitalization (days)	Hip Harris Score	Limited ROM (no of patients)	Pain (no of patients)	Complications
Nusem 2006[19]	22.3	No	No	-	4.0	-	0	-	none
Blitzer 1993 [37]	20.4	No	No	-	-	-	-	-	-
Lee 2014 [3]	18.0	yes	yes (1)	recurrence of pain, ESR and CRP elevation	-	-	-	-	none
Schröder 2016 [38]	26.4	No	yes (3)	stage III Gatcher point	12.4	94.00	0	-	none
Duman 2020 [17]	26.1	No	No	-	4.2	96.30	0	-	none
Kim 2018 [39]	16.0	No	No	-	-	-	-	-	joint collapse
Thompson 2017 [4]	16.0	yes	yes (2)	pain/effusion	4.0	-	0	0	FNP, AVN
Kim 2003 [20]	59.0	No	No	-	-	97.90	0	0	none
Nusem 2012 [40]	1.5	-	No	-	-	-	-	-	-

Table 3. Continued

Sanpera 2016 [41]	-	No	yes (2)	persistent high fever	-	-	0	-	-
Fukushima 2021 [21]	40.2	No	No	-	34.4	-	-	-	none
Danilov 2023[42]	0.0	No	Yes (1)	-	-	-	-	-	-
Eberhardt 2013 [43]	0.0	No	Yes (1)	-	-	-	0	0	none
Chung 1993 [44]	8.0	No	No	-	-	-	0	-	focal metaphyseal radiodensity, enlargment of femoral epiphysis
El-Sayed 2008 [45]	21.7	-	No	-	3.8	-	2	1	none
Edmonds 2018 [46]	-	-	Yes (2)	persistent symptoms	-	-	-	0	none
Garg 2020 [47]	22.0	No	Yes (1)	-	-	-	-	0	FNP, AVN
Tiwari 2015[48] *	45.0	No	No	-	-	76.82	-	-	none
Zhou 2023[49] **	28.6	No	No	-	-	81.36	0	0	none
Kamiński 2007 [50]	52.0	No	No	-	16.4	-	0	0	none
Harada 2019 [1]	12	-	-	-	-	-	-	-	-
Khazi 2020[51]	1	-	-	-	-	-	-	-	Local wound infection, Dehiscence, Pneumonia, Systemic infection, Venous thromboembolism, Deep vein thrombosis, pulmonary embolism, Blood trensfusion

Days of hospitalization reported as mean, follow-up reported as mean (months), revision reported as yes/no (number of patients with revision), Hip Harris Score reported as mean. FNP=femoral nerve palsy, AVN =avascular necrosis

Table 4. Quality Assessment of Case Series

	1	2	3	4	5	6	7	8	9	10
Nusem [19]	yes	yes	yes	yes	yes	yes	yes	NA	yes	Good
Schröder [38]	yes	yes	yes	no	yes	yes	yes	NA	yes	Good
Duman [17]	yes	yes	yes	yes	yes	yes	yes	NA	yes	Good
Kim [39]	yes	no	CD	no	yes	yes	yes	NA	yes	Fair
Thompson [4]	yes	yes	yes	no	no	no	CD	NA	no	Poor[1]
Kim [20]	no	no	CD	no	yes	no	yes	NA	yes	Poor[2]
Nusem [40]	no	no	CD	no	yes	no	yes	NA	no	Poor[3]
Sanpera [41]	yes	no	yes	yes	yes	yes	yes	NA	yes	Fair
Blitzer [37]	no	yes	CD	no	yes	no	yes	NA	yes	Fair
Lee [3]	yes	yes	yes	no	yes	yes	yes	NA	yes	Fair
Fukushima [21]	yes	yes	yes	no	yes	yes	yes	NA	yes	Fair
Eberhardt [43]	yes	yes	yes	no	yes	no	no	NA	yes	Fair
Chung [44]	no	no	CD	no	yes	no	yes	NA	no	Poor[4]
Edmonds [46]	yes	yes	yes	yes	yes	yes	NA	yes	yes	Good
Garg [47]	yes	yes	yes	no	yes	yes	no	NA	yes	Fair
Zhou [49]	yes	yes	yes	yes	yes	yes	yes	yes	yes	Good
Kamiński [50]	yes	yes	yes	yes	yes	no	yes	NA	yes	Fair
Danilov [42]	yes	yes	yes	yes	yes	yes	NA	yes	yes	Good

NA: not applicable; CD: could not determine

Table 5. Quality Assessment of Comparative Studies Based on Nos Criteria

First author	selection				comparibility		outcome			Quality of study
	Representativeness of the exposed cohort	*Selection of the non-exposed cohort*	*Ascertainment of exposure*	*Demonstration that outcome of interest was not present at start of study*	*The study controls for age, sex and marital status*	*Study controls for other factors*	*Assessment of outcome*	*Was follow-up long enough for outcomes to occur*	*Adequacy of follow-up of cohorts*	
El sayed [45]	1	2	3	4	5	6	7	8	9	
Harada [1]	*	*	*	*	*	*	*	*	*	9/Good
Khazi [51]	*	*	*	*	*	*	*	*	*	9/Good
Tiwari [48]	*	*	*	*	-	-	*	*	*	7/Fair

Five studies were analyzed for HHS and the mean value was 93.448 post operatively (CI=92.623 to 94.273, I^2=98; [Figure 2]). The mean rate of revision was 0.099 among 20 analyzed studies (CI=0.065 to 0.149, I^2=0; [Figure 3]). The mean rate of unresolved pain after arthroscopy was 0.037 (CI=0.015 to 0.089, I^2=0; [Figure 4]) in the eight included studies.

Among 17 case series, arthroscopic related complications were reported in nine studies, and six studies reported no complications. Patients achieved a full range of motion in 13 studies. Resolution of pain was reported in 11 studies as well. Only four studies reported recurrence of infection in their patients post-operatively [Table 3].

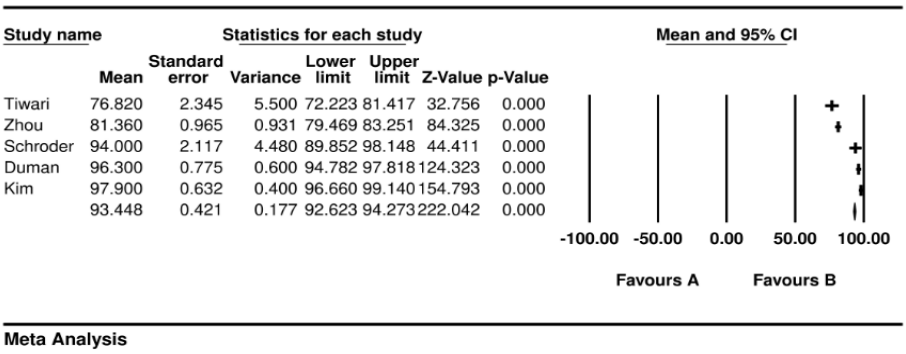

Figure 2. Forest Plot of Postoperative Harris Hip Scores (HHS): A forest plot showing the pooled mean Harris Hip Score (HHS) across five studies included in the meta-analysis. The mean HHS was 93.448 (95% CI = 92.623 to 94.273) with significant heterogeneity (I^2 = 98%). This suggests excellent functional outcomes following arthroscopic treatment of SAH

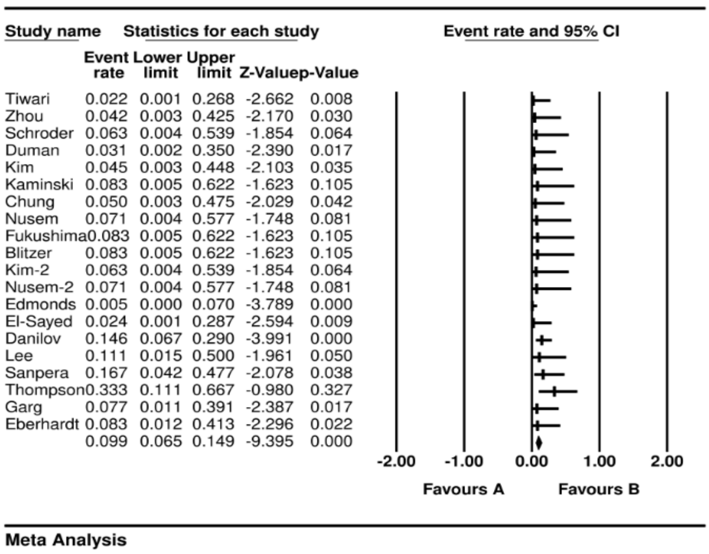

Figure 3. Forest Plot of Revision Surgery Rates: This forest plot displays the pooled mean rate of revision surgeries across 20 studies. The mean revision rate was 0.099 (95% CI = 0.065 to 0.149), with no significant heterogeneity (I^2 = 0%). The figure reflects the relatively low revision rates following arthroscopy for SAH

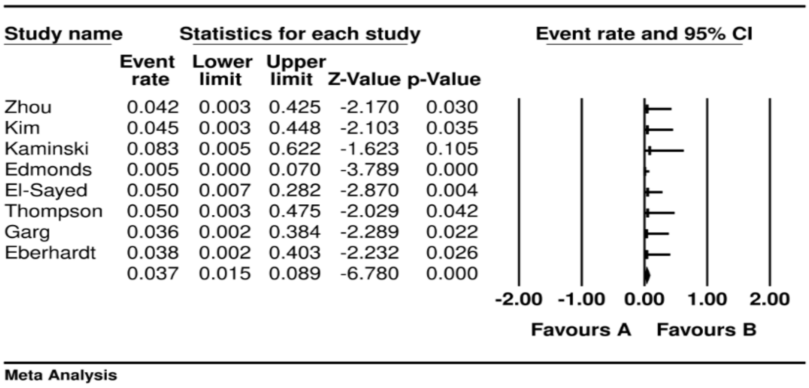

Figure 4. Forest Plot of Unresolved Pain Rates: This forest plot illustrates the pooled mean rate of unresolved postoperative pain across eight studies. The mean unresolved pain rate was 0.037 (95% CI = 0.015 to 0.089), with no significant heterogeneity (I^2 = 0%). The figure highlights the low occurrence of unresolved pain following arthroscopy

Comparative Studies

Study by El-sayed evaluated outcomes of arthroscopy versus arthrotomy in pediatric cases of SAH prospectively.[45] They compared two groups, each consisting of ten cases. Infection was eradicated in all patients and no recurrence occurred in either group. Results were evaluated according to Bennet's classification. In the arthrotomy group 70% had excellent results and the others were classified as good. In the arthroscopy group 90% were determined to have excellent results and the rest ended-up with good results. Duration of days of hospital stay was 6.4 (range 4-9) and 3.8 (range 3-6) in arthrotomy and arthroscopy groups, respectively.

A study by Tiwari et al. Compared outcomes of arthroscopy vs conservative treatment in pediatric patients with hip tuberculosis.[48] Retrospectively, they included 22 cases treated with arthroscopy and 44 cases with conservative treatment by age matching. They showed that involvement of labrum is associated with poor results. They found statistically significant improvements in mean HHS scores in the both groups pre- and post-operatively ($p<00.1$ in the arthroscopy and $p<0.05$ in conservative treatment groups). The improvement was higher in arthroscopic group. Among the advantages of arthroscopy, the ability of obtaining samples for histopathology and culture was also noted.

In 2019, Harada et al.[1] performed a 10-year retrospective study to compare bedside closed-needle joint aspiration and surgical treatment (arthroscopy/arthrotomy) for SAH. Twenty patients were allocated to medical group and 41 to the surgical group. The mean age of patients was 67 years. They did not separate arthroscopy and arthrotomy patients in the surgical group. Additionally, they did not report the exact number of patients with SAH considering that they included all joints in their study. Their results found no statistical difference between functional outcomes in the long-term follow-up.

Khazi et al. compared short term complications in arthrotomy versus arthroscopy in SAH.[51] They included 421 patients in their study using PearlDiver database, only 34 patients (8.1%) of this population had undergone arthroscopy and the rest (91.9%) received arthrotomy. Most patients in both groups were under 60 years old. The rate of total adverse events was lower in arthroscopy group (52.94% versus75.71%, $p=0.0038$). They found no difference between these two groups in return to operating room rate (ROR) within 30 days ($p=0.3836$). Preoperative septicemia was a risk factor for ROR ($p=0.0026$). At last, they considered arthroscopy a reliable option in comparison with arthrotomy.

Discussion

In this review we have found a mean post-operational HHS of 93.45 which represents excellent outcome, with a revision rate of 9.9%, and a relatively low complication rate. These results suggest that hip arthroscopy for SAH is a safe and efficient method. Arthroscopy is a potent and minimally invasive method for SAH treatment due to its ability to provide superb visualization and direct inspection of cartilage surfaces of the femur, the acetabula and extra-articular structures around the hip.[21,26]

The procedure must be executed well with the lowest injury possible to avoid any iatrogenic injury or subsequent complications, hence some technical considerations must be regarded. Some protocols suggest drain placement to evaluate articular fluid volume or remaining infection, additionally catheter flushing after surgery may decrease intra-articular adhesions and recurrence in the setting of recalcitrant infections such as brucellosis.[38,49] Drains will be replaced 2-4 days post-operatively or in cases with recalcitrant infections, when inflammatory markers (ESR, CRP) have markedly decreased.[38,49] However, drain placement may induce secondary infection and subsequent revision demand.[38] Our analysis of revision cases shows low heterogeneity, therefore subgrouping the studies based on drainage placement would not show any specific results.

There is no standard approach for portal establishment, studies placed between 2 and 4 portals with different approaches, however recent studies have introduced more effective and less invasive approaches to lower the iatrogenic injuries and complications. For instance, Duman et al[17] have suggested two portal placement and noted that the anterolateral portal has a much higher risk for damaging the lateral cutaneous nerve and provides insufficient visualization in medial part of hip and femur neck. Hence, they have utilized the sub-adductor portal instead of the conventional anterolateral portal which provides sufficient visualization in the anatomic areas mentioned before. In addition, guidewires and spinal needles accompanied with fluoroscopic guide are beneficial in the course of surgery to minimize iatrogenic cartilage injury. Similarly, Schröder et al.[38] have suggested peripheral compartment approaches to decrease the risk of cartilage damage. In pediatric hip flexion and aiming the trocars at the femoral neck may reduce intra-articular injuries, this method was successfully executed in a 3-month-old patient.[47] Some other approaches have been introduced in order to access the pelvic space for intrapelvic or psoas abscesses treatment. However, these studies are in their infancy and have low population designs.[24,39]

If synovectomy is indicated, it can be accurately done with arthroscopic methods, the arthroscope magnifies the hip space and structures, and then with arthroscopic instruments such as a shaver and plasma radiofrequency, the necrotic synovium or even bone can be debrided precisely.[26,49]

Desa et al.[18] conducted a systematic review evaluated the SAH arthroscopy and its efficacy to eradication the infection at 2015. They included 11 studies which contains a total 65 hips which underwent SAH arthroscopy. All studies demonstrated notable enhancements in patient pain relief and functional outcomes. Additionally, improvements were seen in the ROM, as well as in HHS. There were no reported major complications, and only 1 out of 65 hips (1.5%) required a follow-up revision arthroscopy. The results are in concordance with our study in terms of HHS, and ROM. However, we found a relatively higher revision rate (9.9%), this might be due to including studies which treated patients with a more advanced infection,[42] abscess establishment,[39] or presence of recalcitrant pathogens.[48,49] Our study had included studies with a longer mean follow up duration (average 21.8 months) compared to previous study (19.1). In addition, our study encompassed 35 studies, which included a total 313 hips underwent arthroscopy.

Contraindications for SAH arthroscopy have been the subject of debate for a while, the previous systematic review by Desa et al.[18] reported that arthroscopy is contraindicated for situations where the diagnosis of SAH is confirmed and also one of these conditions is present: tuberculosis or fungal infection, osteomyelitis, immunocompromised patient, and prior surgery on the infected hip.[18] When diagnosis and treatment are delayed or inadequate with the presence of concomitant osteomyelitis, arthroscopic treatment may induce AVN.[17] Other studies have suggested radiological signs of osteochondral involvement resembling Gachter stage IV, extra-articular dissemination of the infection as contraindications for arthroscopy, synovectomy for patients with Gachter stage III is indicated and these patients could be scheduled for a second look arthroscopy.[17,38] However recent studies have demonstrated arthroscopy may be a viable method for treating some of these conditions.[22, 39, 42, 48, 49, 52-54]

The scope of this review focuses on native hip septic arthritis. However, arthroscopic intervention has shown promising outcomes in the management of periprosthetic joint infections (PJI) following total hip arthroplasty (THA). The evidence regarding hip arthroscopy and its indications in PJI after THA remains limited. In a prospective study, eight consecutive patients who developed late-acute PJIs following THA underwent arthroscopic surgery. After an average follow-up period of 70 months, no cases of recurrent infection were observed. The researchers concluded that arthroscopic irrigation and debridement could be an effective treatment option for carefully selected patients with late-onset acute periprosthetic hip infections.[55] In another study, two patients with infected THA were successfully managed with arthroscopic debridement and intravenous antibiotic therapy, with no recurrent infections reported after 3 years of follow-up in both cases.[56] A previous international consensus meeting held in Philadelphia in 2018 noted that the generalizability of arthroscopic management of PJIs is limited due to small patient samples and specific criteria. Comparative studies suggest that open debridement is more effective, and current literature advises against routine arthroscopic surgery for PJIs.[57] High-quality clinical trials are necessary to determine the role of hip arthroscopy in PJI management.

Tiwari et al.[48] treated tuberculosis SAH arthroscopically and medically, and the arthroscopic group showed statistically significant superior results and concluded that arthroscopy can play an important role in treating tuberculosis SAH. They also mentioned that labral tears may influence the prognosis adversely. Moreover, Zhou et al.[49] also conducted a case series of treating brucellosis via arthroscopy, and the outcomes were promising with a final mean HHS of 81.4 (good) and a mean VAS score of 1.64 which significantly improved compared to the pre-operative condition.

Kim et al.[39] retrospectively reviewed 7 cases of SAH with concomitant psoas abscess that were treated arthroscopically. Three of the patients were cured completely. However, prior comorbidities and advanced infection may be responsible for the relatively poor outcome. In addition, Danilov et al.[42] treated 10 pediatric patients of SAH combined with osteomyelitis, and 6 of them required a second surgery. At the last follow up all patients were cured.

Recently, arthroscopic approach has been considered as a viable and standard option in patients without radiologic alterations resembling osteochondral destruction or extra-articular involvement.[38] Even in medically compromised individuals or those with concomitant osteomyelitis, arthroscopy has showed promising outcomes. However, in such settings, more than one procedure is obligatory and recurrence rate may increase.[26,42,58] In addition, whenever arthrocentesis and medical treatment for pediatric patients fails, arthroscopy is an excellent rescue treatment and demonstrated great outcomes.[41]

Few studies have compared arthroscopy and other treatment methods. Generally, compared to arthrotomy, arthroscopy is the superior technique in many aspects.

Arthroscopy offers minimally invasive approach with less peri-operative morbidity due to accurate debridement of necrotic tissue and lower damage to extra-articular structures. Arthroscopy also provide shorter hospital stay and lower post-operative pain. Arthroscopy is the ideal technique if repeated washout is indicated.[21,39,48,51] Additionally, the femoral head dislocation for joint irrigation or debridement, iatrogenic injuries to the lateral cutaneous nerve and vasculature of femoral head is more common in arthrotomy. Due to arthroscopy's minimally invasive properties, in younger patients especially, it is the superior approach. [42, 48, 51, 59, 60] However, some complications may occur during arthroscopy such as sciatic, femoral and pudendal nerve injury, fluid extravasation, instrument breakage, and cartilage or labral damage.[17,48]

Khazi et al.[51] compared arthrotomy and arthroscopy for SAH treatment, the results demonstrated that arthrotomy group has significantly higher total adverse events. However, the retune to operative room rate was similar between two cohorts. In a similar study El-sayed et al.[45] concluded in arthroscopy cohort, days of hospitalization are significantly lower than arthrotomy group. In addition, in arthrotomy cohort the clinical outcomes were slightly poorer.

Tiwari et al.[48] which conducted a study on tuberculosis induced SAH, reported arthroscopic treatment demonstrated significantly preferable clinical outcomes (HHS) compared to medical treatment in all SAH stages. However, Harada et al.[1] suggest arthrocentesis combined with medical treatment is a viable option for septic arthritis and has equal mid-term outcomes compared to arthroscopy management. Although, due to this study included all other joints (knee, wrist, elbow, etc.) beside hip, arthrocentesis for SAH could not relied easily.

Based on these outcomes, we can claim arthroscopy is superior to arthrotomy because of its minimally invasive, better clinical outcomes, and swifter rehabilitation properties. However, studies on this subject are scarce. Hence, high quality comparative studies are recommended.

Limitations

This study has several limitations. First, the majority of included studies had a non-comparative design with a limited sample size. Consequently, due to the small sample size, some adverse events or complications may have been missed, introducing bias. Second, the hip arthroscopy procedure is highly skilled and demanding, and many hospitals may not have expert surgeons capable of executing joint irrigation and debridement precisely. Therefore, the included studies may have had expertise bias. We recommend publishing detailed surgical notes and techniques for the arthroscopic management of SAH to assist less experienced surgeons. In addition, the studies did not report traction times or whether perineal posts were used during the procedure, both of which are important aspects of hip arthroscopy. Third, the included studies were heterogeneous in terms of patient population, outcome measures, and baseline characteristics. For instance, the patients' ages ranged from infants to the elderly, and the reported outcomes varied, including HSS score, VAS score, range of motion, etc. Additionally, some studies included patients with end-stage, chronic, and disseminated or abscessed infections, while other studies included patients with early-stage and localized infections. Based on these limitations, we highly recommend conducting high-quality randomized studies comparing arthroscopy and arthrotomy for the surgical management of SAH.

Conclusion

In Conclusion, arthroscopic approach for SAH treatment is a safe, efficient, and minimal invasive option with good clinical outcomes, relatively low revision and complications rates, and swift rehabilitation period.

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