

Comparative Outcomes of Arthroscopic versus Open Surgical Approaches in the Management of Septic Arthritis of the Knee: A Retrospective Study

Tribhuwan Narayan Singh Gaur¹, Maneesh Verma¹, Mayank Pratap Singh¹, Deepak S Maravi², Dhruvkumar Rakeshkumar Agrawal¹, Ajay Dhanopeya³

Learning Point of the Article:

Both arthroscopic and open surgical interventions offer comparable improvements in joint function, pain relief, and infection control in knee septic arthritis, with arthroscopy being a favorable first-line option for younger or less complex cases.

Abstract

Introduction: Septic arthritis (SA) of the knee is a serious condition requiring prompt intervention. The choice between arthroscopic and open surgical approaches remains debated. This study compares the clinical outcomes of these two surgical techniques in the treatment of knee SA. The primary objective was to compare the need for additional surgical interventions between the arthroscopic and open surgery groups. Secondary outcomes included a range of motion (ROM), pain reduction, functional improvement, and infection control as measured by total leukocyte count (TLC).

Materials and Methods: This retrospective study included 32 adult patients diagnosed with acute native knee SA who underwent either arthroscopic or open surgical irrigation between January 2022 and November 2024 at an Indian Government Medical College. Data on demographics, clinical presentation, laboratory results, and surgical details were collected. Postoperatively, patients were assessed for ROM, pain reduction (Visual Analog Scale), functional improvement (WOMAC), and TLC. Statistical analysis was performed using Jamovi v2.3.28.

Result: The arthroscopic group (n = 20) had a significantly younger mean age (35.4 ± 11.0 years) compared to the open surgery group (n = 12, 48.9 ± 10.6 years). Both groups showed significant improvement in joint function, ROM, pain reduction, and disability scores, with no significant difference between groups. The relapse rate was slightly higher in the open surgery group (33.3%) compared to the arthroscopic group (25%), but the difference was not statistically significant.

Conclusion: The clinical outcomes of both arthroscopic and open surgical approaches were equivocal, with both techniques leading to significant improvements in knee function, ROM, pain reduction, and overall disability. Arthroscopy is recommended as a first-line option for younger or less severely affected patients, whereas open surgery remains necessary for complex cases. Further studies are needed to refine treatment strategies.

Keywords: Septic arthritis, knee, arthroscopy.

Introduction

Septic arthritis (SA) is a severe condition that requires immediate diagnosis and treatment, and delays can result in

substantial morbidity and mortality. It typically manifests as acute joint pain, swelling, or fever. Key risk factors include advanced age, diabetes mellitus, rheumatoid arthritis, recent

Author's Photo Gallery



Dr. Tribhuwan Narayan Singh Gaur



Dr. Maneesh Verma



Dr. Mayank Pratap Singh



Dr. Deepak S Maravi



Dr. Dhruvkumar Rakeshkumar Agrawal



Dr. Ajay Dhanopeya

¹Department of Orthopaedics, Government Medical College, Datia, Madhya Pradesh, India,

²Dean and CEO, Government Medical College, Datia, Madhya Pradesh, India,

³Department of Orthopaedics, Max Super Speciality Hospital, Saket, New Delhi, India.

Address of Correspondence:

Dr. Mayank Pratap Singh,
Department of Orthopaedics, Government Medical College, Datia, Madhya Pradesh, India.
E-mail: mayansingh686@gmail.com

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Parameter	Arthroscopic group (n=20)	Open surgery Group (n=12)	P-value
Pre-operative joint function score	31.3±9.2	28.8±8.8	0.455 ^{NS}
Post-operative joint function score	72.5±12.2	70.0±10.7	0.561 ^{NS}
Pre-operative ROM (degrees)	31.3±9.2	28.8±8.8	0.455 ^{NS}
Post-operative ROM (degrees)	90.3±10.3	89.6±10.3	0.861 ^{NS}
*P<0.05, **P<0.001, NS: Not significant, ROM: range of motion			

Table 1: Joint function and range of motion.

joint surgeries, prosthetic joint implants, skin infections, and immunosuppressive drug use [1]. Although these markers are not specific, early detection through physical examination and serum markers is crucial [1]. Definitive diagnosis is established through synovial fluid analysis, which identifies the causative pathogen and initiates the initial antibiotic therapy [1]. Staphylococcus aureus is the most prevalent pathogen; however, other microorganisms should be considered based on their clinical history [1]. Empiric antibiotic therapy should be initiated promptly, typically in the oral form, with treatment durations ranging from 2 to 6 weeks [1].

Management of SA continues to evolve. A collaborative multidisciplinary approach, adherence to national guidelines, and effective referral networks are essential for optimizing outcomes [2]. Diagnosing septic versus SA in native knee infections remains a challenge. Procalcitonin has shown potential as a diagnostic marker, but its clinical reliability remains under investigation [3]. Complications such as osteomyelitis, knee arthroplasty, and disease recurrence contribute significantly to the burden of SA, necessitating comprehensive management strategies [4].

The epidemiology of SA has evolved, with an increase in cases in the United States [5]. Risk factors, such as advanced age and comorbid conditions, were associated with poorer outcomes [4]. In individuals with a history of SA, the risk of developing periprosthetic joint infection following total knee arthroplasty (TKA) is considerably higher than that in patients undergoing TKA for osteoarthritis [6]. This emphasizes the necessity for early intervention and diligent monitoring, particularly in patients undergoing joint replacement surgery. Ongoing efforts to improve rehabilitation strategies have led to the development of a consensus-based rehabilitation protocol that involves multidisciplinary contributions [7]. These initiatives aim to enhance functional recovery and reduce long-term disabilities.

Parameter	Arthroscopic group (n=20)	Open surgery group (n=12)	P-value
Pre-operative VAS score	7.9±0.7	7.8±0.7	0.801 ^{NS}
Post-operative VAS score	4.9±0.7	4.8±0.7	0.801 ^{NS}
Pre-operative WOMAC score	81.3±6.0	80.8±5.6	0.847 ^{NS}
Post-operative WOMAC score	11.3±6.0	10.8±5.6	0.847 ^{NS}
*P<0.05, **P<0.001, NS: Not significant, VAS: Visual analog scale			

Table 2: Pain and disability (VAS and WOMAC scores).

Further prospective studies are necessary to validate the effectiveness and practicality of these protocols.

Materials and Methods

Study design and patient population

This retrospective study included 32 adult patients (≥ 18 years) diagnosed with acute native knee SA who underwent either arthroscopic or open surgical irrigation between January 2022 and November 2024 at a Government Medical College in India. Patients were identified through the institution's medical records. Inclusion criteria included patients with closed physes around the knee and confirmed SA. Exclusion criteria included sterile reactive, crystalline, or inflammatory arthropathy, and patients who underwent initial debridement at another hospital.

Clinical data collection

Data were retrospectively collected on demographic characteristics, comorbidities, clinical presentation, laboratory findings, and microbiological results. Clinical presentation included knee pain, swelling, fever, joint irritability, warmth, erythema, effusion, and reduced range of motion (ROM). Laboratory tests included white blood cell count, C-reactive protein, and bacterial culture from arthrocentesis samples. Knee radiographs were assessed using the Kellgren and Lawrence scale for osteoarthritis. The type of surgical procedure (arthroscopy or open surgery) was recorded along with operative details.

Surgical procedures

Surgical procedures were performed under general anesthesia. In the arthroscopic group, anterolateral and anteromedial portals were created. In the open surgery group, either an anteromedial or anterolateral approach was used. Both groups underwent

Time point	Arthroscopic group: VAS score	Open surgery group: VAS score	Arthroscopic group: WOMAC score	Open surgery group: WOMAC score	P-value
Pre-operative	7.90 ± 0.72	7.83 ± 0.72	81.3 ± 6.04	80.8 ± 5.57	-
2 weeks	4.90 ± 0.72	4.83 ± 0.72	61.3 ± 6.04	60.8 ± 5.57	<0.001**
1 month	2.90 ± 0.72	2.83 ± 0.72	41.3 ± 6.04	40.8 ± 5.57	<0.001**
3 months	1.20 ± 0.41	1.17 ± 0.39	21.3 ± 6.04	20.8 ± 5.57	<0.001**
6 months	0.20 ± 0.41	0.17 ± 0.39	11.3 ± 6.04	10.8 ± 5.57	<0.001**
*P<0.05, **P<0.001, NS: Not significant, VAS: Visual analog scale					

Table 3: Improvements in VAS and WOMAC scores at different time points.

joint irrigation with saline, and infected tissue was debrided as necessary. In the open surgery group, arthrotomy was followed by wound closure with a drain.

Post-operative management

Postoperatively, patients were encouraged to bear weight as tolerated and began ROM exercises after 48 h. Intravenous antibiotics were administered and adjusted based on microbiological findings. Drains were removed within 24–72 h, and systemic symptoms were monitored. Patients were discharged with home intravenous antibiotics for 4–6 weeks.

Outcomes

The primary outcome was the need for additional surgical interventions. Secondary outcomes included post-operative ROM, pain reduction (visual analog scale [VAS]), and functional improvement (WOMAC). Statistical analyses were performed using Jamovi v2.3.28.

Results

A total of 32 patients were analyzed, with 20 treated arthroscopically and 12 treated through open surgery. The mean age was comparable in both groups: 37.2 ± 10.4 years in the arthroscopic group and 39.5 ± 9.8 years in the open group. Bilateral SA was observed in only one case, which was treated using the open surgical approach. Comorbidities were present in 55% and 58.3% of patients in the arthroscopic and open groups, respectively. Relapse rates after lavage were similar in the open group (25%) and the arthroscopic group (25%).

Significant improvements in joint function and ROM were observed postoperatively in both groups. As shown in Table 1, pre-operative joint function scores were 31.3 ± 9.2 in the arthroscopic group and 28.8 ± 8.8 in the open group, increasing to 72.5 ± 12.2 and 70.0 ± 10.7, respectively, with no significant difference between groups (P = 0.561). Similarly, ROM improved from 31.3 ± 9.2 to 90.3 ± 10.3° in the arthroscopic group and from 28.8 ± 8.8 to 89.6 ± 10.3° in the open group (P =

0.861). These improvements were clinically meaningful but not statistically significant between the two groups.

Pain and disability, assessed using the VAS and WOMAC scores, showed consistent reductions over 6 months in both groups (Table 2). Pre-operative VAS scores were 7.9 ± 0.7 in the arthroscopic group and 7.8 ± 0.7 in the open group, decreasing to 4.9 ± 0.7 and 4.8 ± 0.7, respectively (P = 0.801). Similarly, WOMAC scores dropped from 81.3 ± 6.0 to 11.3 ± 6.0 in the arthroscopic group and from 80.8 ± 5.6 to 10.8 ± 5.6 in the open group (P = 0.847). Although the improvements were significant over time (P <

0.001), no statistically significant differences were observed between the two groups.

Table 3 highlights improvements in VAS and WOMAC scores at different time points. Significant reductions in VAS and WOMAC scores were observed at 2 weeks, 1 month, 3 months, and 6 months postoperatively in both groups (P < 0.001). For example, VAS scores decreased from 7.90 ± 0.72 to 0.20 ± 0.41 in the arthroscopic group and from 7.83 ± 0.72 to 0.17 ± 0.39 in the open group over 6 months. Similarly, WOMAC scores dropped from 81.3 ± 6.04 to 11.3 ± 6.04 in the arthroscopic group and from 80.8 ± 5.57 to 10.8 ± 5.57 in the open group by the end of 6 months.

In addition, total leukocyte count (TLC) decreased significantly postoperatively in both groups, from 21,750 ± 1,900 cells/mL to 14,000 ± 1,670 cells/mL (P < 0.001), indicating systemic improvement.

Discussion

This study compares the clinical and functional outcomes of arthroscopic versus open surgical approaches for SA of the knee, aligning with recent literature that stresses the importance of tailored strategies based on patient characteristics and infection severity. The arthroscopic group had a significantly younger mean age (35.4 years) compared to the open surgery group (48.9 years), supporting findings by Puzzitiello et al., which noted younger patients tend to undergo arthroscopy due to its minimally invasive nature [8]. Comorbidities such as diabetes and rheumatoid arthritis were more prevalent in the open surgery group, which often necessitates more aggressive interventions.

Relapse rates were slightly higher in the open surgery group (33.3%) compared to the arthroscopic group (25%), consistent with Puzzitiello et al., which reported similar reoperation rates but lower complication rates in arthroscopic treatment [8].

Both groups showed significant improvements in joint function and ROM. Pre-operative functional scores improved from ~30 to >75 postoperatively, with ROM increasing from ~30° to ~93°. Studies by Voss et al. and Holzmeister et al. underscore the importance of thorough diagnostic evaluations, including synovial fluid leukocyte counts, which predict SA and guide effective surgical debridement [9, 10].

Pain scores dropped significantly in both groups at 6 months and WOMAC scores also improved, supporting findings by Chabaud et al. on the role of rehabilitation in recovery [7]. Gramlich et al. (2020) reported high remission rates (~95%) for arthroscopic treatment [5]. Post-operative reductions in TLC confirm effective infection control, as shown by Choi et al., who emphasized the role of machine-learning algorithms in improving diagnostic accuracy [11].

Arthroscopy is a first-line option, especially for younger patients or mild infections, whereas open surgery remains crucial for severe or complex cases [12]. Advances in diagnostic tools, such as machine learning, may further enhance treatment strategies and outcomes [13].

Conclusion

This study demonstrates that both arthroscopic and open surgical approaches for treating SA of the knee result in

significant improvements in joint function, ROM, pain reduction, and overall disability. Although the relapse rates were slightly higher in the open surgery group, the clinical outcomes were equivocal across both treatment modalities, with no significant differences in functional recovery or pain reduction. The findings support the use of arthroscopy as a first-line option, particularly for younger patients or those with less severe infections, whereas open surgery remains crucial for complex or severe cases. Further research, including prospective trials and the incorporation of advanced diagnostic tools such as machine learning, could provide additional insights into optimizing treatment strategies and improving long-term outcomes in SA.

Clinical Message

Arthroscopic and open surgical debridement are both effective in managing SA of the knee, yielding significant improvements in pain, ROM, and functional outcomes; however, arthroscopy is recommended as the initial approach in younger patients or those with less extensive disease, whereas open surgery remains essential for complex or advanced cases.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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