

TREATMENT

Authors: Robert van der Wal, James Murray, Clare Taylor

QUESTION 1: Can arthroscopy be used for management of patients with acute sepsis of the native knee joint?

RECOMMENDATION: Yes. Arthroscopy can be used for treatment of acute sepsis of the native knee joint.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

RATIONALE

An extensive literature search was conducted to identify all publications related to the use of arthroscopy for management of acute septic arthritis of the native knee. A total of 18 publications were identified for review and of these, 1 was excluded as the cohort included patients with periprosthetic joint infection. Three publications were not available despite all attempts to retrieve them. Fourteen papers were reviewed in full, including five publications reporting results from the pediatric population. There was one randomized controlled trial by Peres et al., and the remaining studies were retrospective reviews [1]. In the management of septic arthritis of the native knee, the two key points to address are successful clearance of infection and minimization of complications. The pediatric papers have been reviewed separately.

Adults:

Seven papers compared arthroscopic management with arthrotomy and two papers reported only on arthroscopic results.

Jeffé et al. described successful infection clearance at four months with one procedure in 75.8% (25/33) treated with arthroscopy and 80.9% (38/47) treated with arthrotomy. This difference was not statistically significant [2]. After further statistical analyses, failure in the arthroscopic group was associated with infection being caused by methicillin-resistant *Staphylococcus aureus* (MRSA) (five out of eight failures). Similar success rates were reported by Balabaud et al. accounting for 72% (16/21) for arthroscopy and 84% (16/19) for arthrotomy [3]. Böhler et al. reported significantly lower reoperation rates and significantly better functional outcomes in patients treated arthroscopically. They achieved clearance with one procedure in 95.1% (39/41) treated arthroscopically and 79.3% (23/29) treated with arthrotomy [4]. Dave et al., with follow-up of up to 7.2 years, reported success rates of 77.8% (28/36) with arthroscopy and 60% (6/10) with arthrotomy [5]. They found no relationship between using arthroscopy and the need for multiple procedures but they did report a statistically significant relationship between the number of hours between onset of symptoms and time to index procedure and the need for multiple procedures in the group as a whole [5].

Wirtz et al. had higher success rates, at 93% (25/27) with arthroscopy and 83% (20/24) with arthrotomy [6]. A large study by Johns et al. found a 2.6 times higher chance of needing further surgery in the arthrotomy group, although overall their success rates from the primary procedure were lower than other studies with a reported success rate of 50% (59/119) for arthroscopy and 29% (12/42) for arthrotomy [7].

These results support the use of arthroscopy as the initial treatment, and are backed up by the randomized controlled trial by Peres

et al. with two-year follow-up reporting 100% (10/10) success rate for arthroscopy compared to 82% (9/11) for arthrotomy [1]. However, the small sample size, and the low rate of culture positivity (at 47.6%) raises concern that some of these patients may have suffered inflammatory conditions and were not truly infected.

Complications:

Complications other than reoperation were not uniformly reported in all papers. On univariate analysis by Bovonratwet et al., higher mortality and serious adverse events were associated with arthroscopy and higher transfusion rates and minor adverse events were encountered after arthrotomy [8]. On multivariate analysis, controlled for age and American Society of Anesthesiologists (ASA) grade, there was no statistically significant difference between the risk of all adverse events or readmission. Johns et al. [7] and Böhler et al. [4] reported median knee range of motion post-arthroscopy being statistically significantly higher, in contrast to other studies discussed above. However, they did report pain at 7 and 14 days being statistically significantly better in the arthroscopy group, and reported significantly more local warmth and redness in the arthrotomy group at 1 week.

Pediatric Cases:

In the management of pediatric patients with septic arthritis of the knee, the results from five retrospective reviews also supported the use of arthroscopy. However, positive culture results ranged from 48% to 62.5%, when documented. Johns et al. concluded that arthroscopy was more successful than arthrotomy in reducing return to theatre and regaining knee function earlier. However, on long-term follow-up (mean 6.9 years) they found no significant difference between the groups [7]. Success following the first procedure was reported in 11/11 (100%) for arthroscopy and 8/13 (61.5%) following arthrotomy [7]. The other four papers on managing pediatric patients only reported results of arthroscopy. Success rates were 54/56 (96%) from Agout et al. [9], 5/5 (100%) from Sanchez and Hennrikus [10], 15/16 (93.8%) from Ohl et al. [11] and 16/16 (100%) from Stanitski et al. [12].

Complications other than return to operating room were reported in all papers, but not uniformly. At 6.9 years of follow-up, Johns et al. found no difference between the Knee Injury and Osteoarthritis Outcome Score (KOOS) and Lysholm scores, range of movement, leg length discrepancy (LLD) and gait between the arthroscopy and arthrotomy groups [7]. At three weeks follow-up, Ohl et al. reported that all patients had resumed normal activities and

no abnormalities on radiographs [11]. Agout et al. [9], Sanchez and Hennrikus [10] and Stanitski et al. [12] reported no pain, symmetrical range of movement, no radiographic changes and < 5mm of LLD in all patients at final follow-up.

REFERENCES

- [1] Peres LR, Marchitto RO, Pereira GS, Yoshino FS, de Castro Fernandes M, Matsumoto MH. Arthroscopy versus arthrolysis in the treatment of septic arthritis of the knee in adults: a randomized clinical trial. *Knee Surg Sports Traumatol Arthrosc.* 2016;24:3155–3162. doi:10.1007/s00167-015-3918-8.
- [2] Jaffe D, Costales T, Greenwell P, Christian M, Henn RF. Methicillin-resistant *Staphylococcus aureus* infection is a risk factor for unplanned return to the operating room in the surgical treatment of a septic knee. *J Knee Surg.* 2017;30:872–878. doi:10.1055/s-0037-1598079.
- [3] Balabaud I, Gaudias J, Boeri C, Jenny Y, Kehr P. Results of treatment of septic knee arthritis: a retrospective series of 40 cases. *Knee Surg Sports Traumatol Arthrosc.* 2007;15:387–392. doi:10.1007/s00167-006-0224-5.
- [4] Böhler C, Dragana M, Puchner S, Windhager R, Holinka J. Treatment of septic arthritis of the knee: a comparison between arthroscopy and arthrolysis. *Knee Surg Sports Traumatol Arthrosc.* 2016;24:3147–3154. doi:10.1007/s00167-015-3659-8.
- [5] Dave OH, Patel KA, Andersen CR, Carmichael KD. Surgical procedures needed to eradicate infection in knee septic arthritis. *Orthopedics.* 2016;39:50–54. doi:10.3928/01477447-20151222-05.
- [6] Wirtz DC, Marth M, Miltner O, Schneider U, Zilkens KW. Septic arthritis of the knee in adults: treatment by arthroscopy or arthrolysis. *Int Orthop.* 2001;25:239–241.
- [7] Johns BP, Loewenthal MR, Dewar DC. Open compared with arthroscopic treatment of acute septic arthritis of the native knee. *J Bone Joint Surg Am.* 2017;99:499–505. doi:10.2106/JBJS.16.00110.
- [8] Bovonratwet P, Nelson SJ, Bellamkonda K, Ondeck NT, Shultz BN, Medvecky MJ, et al. Similar 30-day complications for septic knee arthritis treated with arthrolysis or arthroscopy: an American College of Surgeons national surgical quality improvement program analysis. *Arthroscopy.* 2018;34:213–219. doi:10.1016/j.arthro.2017.06.046.
- [9] Agout C, Lakhali W, Fournier J, de Bodman C, Bonnard C. Arthroscopic treatment of septic arthritis of the knee in children. *Orthop Traumatol Surg Res.* 2015;101:S333–S336. doi:10.1016/j.otsr.2015.09.007.
- [10] Sanchez AA, Hennrikus WL. Arthroscopically assisted treatment of acute septic knees in infants using the Micro-Joint Arthroscope. *Arthroscopy.* 1997;13:350–354.
- [11] Ohl MD, Kean JR, Steensen RN. Arthroscopic treatment of septic arthritic knees in children and adolescents. *Orthop Rev.* 1991;20:894–896.
- [12] Stanitski CL, Harvell JC, Fu FH. Arthroscopy in acute septic knees. Management in pediatric patients. *Clin Orthop Relat Res.* 1989;209–212.



Authors: Kevin Plancher, Roberto Rossi, Nirav K. Patel

QUESTION 2: What type of lavage solution should be used in patients with a native knee infection being treated with arthroscopy?

RECOMMENDATION: We recommend that high volumes of saline without antibiotics should be used as the arthroscopic lavage solution for native knee infection.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

RATIONALE

Infection of the native knee can be treated surgically by open or arthroscopic methods [1–3]. Arthroscopic lavage techniques have been used widely, since the introduction of arthroscopic debridement offers the benefits of smaller incisions, decreased tissue damage and lower reinfection rates compared to open methods [1–3]. Arthroscopic treatment yields good to excellent results, though there are a limited number of comparative studies in the literature (many with small sample sizes) [1–10]. Irrigation aids in the removal of debris and decreases the intra-articular concentration of chondrolytic enzymes better than needle aspiration alone [11,12].

There is a general consensus in the literature supporting high-volume (10 to 15 L) arthroscopic lavage with saline combined with intravenous antibiotics both in pediatric and adult patients for septic arthritis [1,3,9,10,13–25]. Based on microbiological findings, lavage plus intravenous antibiotics appears sufficient to eradicate *Staphylococcus aureus*, the most common cause of septic arthritis of the native knee [7]. Two studies with larger patient numbers support saline irrigation without intra-articular antibiotics as the lavage solution of choice [2,7]. A large number of other studies described using saline lavage solution for arthroscopic treatment of knee sepsis, with an average volume of 10.1 L [6,9,17,18,20,22,26–30]. Shinjo et al. compared the effects of two common arthroscopic irrigation solutions on meniscus tissue cells, and demonstrated that Ringer's lactate solution better maintained human meniscus cell integrity than the isotonic saline [31].

Additionally, there is a lack of agreement on the use of intra-articular antibiotics despite their frequent use during arthroscopic treatment of infected native knees in clinical practice without

recommendation, thus warranting further investigation [32,33]. While some are proponents of intra-articular antibiotics, others are concerned about resultant chemical synovitis and potential chondral toxicity, not mentioning the risk of increasing antibiotic resistance [5,34,35]. Only one study by McAllister et al. specifically described using an antibiotic-loaded Ringer's lactate solution during arthroscopic treatment of four postoperative septic knees following anterior cruciate ligament reconstruction. The antibiotic name was not mentioned, but they reported a 100% eradication rate for infection [17]. The use of continuous irrigation-suction drains with antibiotics added to the irrigation solution has been both supported and refuted in the literature [4,5,34,36–38]. Some studies support the use of continuous suction irrigation drains with saline, whereas others caution against their use due to concerns of secondary infection [2,4–7,13,14,14,14,34,36,39].

In conclusion, other than saline, there is limited data to support the use of other arthroscopic lavage fluids for treatment of native knee infections and further comparative clinical studies are needed.

REFERENCES

- [1] Travers V, Norotte G, Roger B, Apoil A. [Treatment of acute pyogenic arthritis of large joints of the limbs. Apropos of 79 cases]. *Rev Rhum Mal Osteoartic.* 1988;55:655–660.
- [2] Stutz G, Kuster MS, Kleinstück F, Gächter A. Arthroscopic management of septic arthritis: stages of infection and results. *Knee Surg Sports Traumatol Arthrosc.* 2000;8:270–274. doi:10.1007/s001670000129.
- [3] Johns BP, Loewenthal MR, Dewar DC. Open compared with arthroscopic treatment of acute septic arthritis of the native knee. *J Bone Joint Surg Am.* 2017;99:499–505. doi:10.2106/JBJS.16.00110.
- [4] Jackson RW, Parsons CJ. Distension-irrigation treatment of major joint sepsis. *Clin Orthop Relat Res.* 1973;160–164.