# Comparison of Arthroscopic and Open Arthrotomy Treatment of Septic Arthritis of the Knee in Thai Patients

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## ABSTRACT

**Objective:** The aim of this study was to present our data comparing clinical results between arthroscopic debridement and open arthrotomy for the treatment of septic arthritis of the knee.

**Methods:** The study was carried out as a retrospective study and was performed in 77 patients who had primary septic arthritis of their knees and were treated at the Department of Orthopaedic Surgery, Faculty of Medicine Siriraj Hospital during 2002 to 2111. Medical records of patients' demographic data and clinical findings and the information of all investigation were reviewed. The early results of the treatment between the patients who underwent arthroscopic debridement and the patients who underwent arthrotomy were analyzed.

**Results:** There were 38 males and 39 females with an average age of 57.7±16.0 years. Thirty three patients were in the arthroscopic group and 44 patients were in the open arthrotomy group. No differences between the two groups were observed with regard to patients' characteristics, demographics data, clinical presentation and laboratory investigations. The most common organisms were *Streptococcus* spp. (39%) and *Staphylococcus aureus* (37%). Less blood loss ($p < 0.01$) and fewer post-operative complications ($p < 0.05$) were observed in the arthroscopic debridement group compared to the open arthrotomy group, even though arthroscopic surgery required a longer operative time ($p < 0.01$). However, there was no difference for the length of the hospital stay between the two groups ($p > 0.05$).

**Conclusion:** Arthroscopic debridement provided good results which were similar to open arthrotomy with less immediate complications.

**Keywords:** Septic arthritis, arthroscopy, open arthrotomy

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## INTRODUCTION

Septic arthritis is a serious orthopaedic condition and a therapeutic emergency associated with substantial morbidity and mortality.[1,2] The knee is the most frequently involved joint.[3] The principles of treatment are organism-specific antibiotics in sufficient dosage combined with emergency decompression of the joint abscess. Various surgical treatments have been proposed: 1) repeated needle aspiration, 2) arthroscopic debridement and 3) open arthrotomy with debridement.[4-9] Recent reports from the '90s demonstrated a potential advantage of the arthroscopic debridement, such as smaller incisions, less pain, better functional outcome, and lower morbidity.[10,11] These better results of arthroscopy were also demonstrated in septic arthritis of the wrist joint and septic arthritis in animal models.[12,13] Epidemiological and clinical characteristics, risk factors, causative organisms, and outcomes have been well described in Thailand.[3,14-16] However, no study specifically addressed the surgical treatment of septic arthritis of the knee. Therefore, this retrospective study was carried out to evaluate the efficacy and safety of arthroscopic debridement compared with open arthrotomy for the treatment of primary septic arthritis of the knee.

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## MATERIALS AND METHODS

All medical records and investigation data of knee septic arthritic patients who were treated at the Department of Orthopaedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand between January 2002 and March 2011 were reviewed. The study was reviewed and approved by the Siriraj Ethics Committee (Si 002/2011[2010-12-30]). The inclusion criteria were 1) patients who had primary septic arthritis of their knees and 2) patients who were older than 20 years. The exclusion criteria were 1) patients who had peri-prosthetic septic arthritis, 2) patients who had previous arthroscopic reconstruction of the injured knee and 3) patients who had post-traumatic septic arthritis of the knee. The diagnosis of septic arthritis of the knee was made on the basis of the history and physical examination of each patient and was supported by laboratory findings in most of the patients before they underwent surgery. They underwent the surgery according to the agreement between the patients and the surgeons in charge.

All data from medical records including; demographic data, underlying medical conditions, previous history of joint diseases, previous orthopedic surgery, clinical presentation (e.g. onset, affected knee), length of stay, operative details (e.g. operative time, intra-operative blood loss, and blood replacement), and post-operative complications, and the information of all investigations including; laboratory and microbiological findings, were collected, analyzed and presented as a descriptive research.

All values were expressed as mean ± standard deviation (SD). Statistical analysis was performed using StatView for windows version 5 (SAS Institute Inc, Cary, NC, USA). Descriptive statistics were calculated and contingency tables were produced. Chi-square tests were performed on categorical variables, while unpaired *t*-test was used to compare the values in open arthrotomy and arthroscopic debridement patients. A p-value $< 0.05$ was considered to be statistically significant.

## RESULTS

There were 33 patients in the arthroscopic debridement group and 44 patients in the open arthrotomy group. There were no significant differences in terms of demographic data, pre-existing joint diseases, clinical findings, clinical course in the hospital, information of investigation, co-morbidities or causative bacterias, between the groups, except height of the patients, Tables 1 and 2. The left knee was the most commonly affected joint in both groups of patients.

The causative organisms were identified in 46 of the 72 patients (63.9%), as shown in Table 3. In both groups, the most common organisms were *Streptococcus* spp., 41.4% in the open arthrotomy group and 35.3% in the arthroscopic group, and *Staphylococcus aureus*, 37.9% in the open arthrotomy group and 35.3% in the arthroscopic group.

There were no significant differences of all data between two groups during the peri-operative period except the operative times and immediate complication rates, as shown in Table 4. In the arthroscopic debridement group, the operative times were significantly longer than the operative times in the open arthrotomy group. On the other hand, complications were found more in the open arthrotomy group (47.7%) compared to the arthroscopic debridement group (24.2%, $p < 0.05$). The common complications were; 1) myocardial infarction in 3 patients, 2) respiratory distress syndrome in 2 patients, 3) pneumonia in 4 patients, 4) septicemia in 1 patient, 5) acute renal failure in 6 patients, 6) electrolyte imbalances in 15 patients, 7) urinary tract infection in 5 patients and 8) decubitus ulcers in 3 patients, as shown in Table 4.

**TABLE 1.** Patients' characteristics and demographic data.

| | No. of patients (%) | | p-value |
|---|---|---|---|
| | Open arthrotomy (n=44) | Arthroscopic (n=33) | |
| Age (yrs)* | 58.6 ± 15.6 | 56.6 ± 16.6 | >0.05[a] |
| Gender | | | |
| Male | 21 (47.7) | 17 (51.5) | >0.05[b] |
| Female | 23 (52.3) | 16 (48.5) | |
| Weight (kg)* | 58.9 ± 12.8 | 60.1 ± 12.2 | >0.05[a] |
| Height (m)* | 1.58 ± 0.08 | 1.64 ± 0.08 | <0.05[a] |
| BMI ($kg/m^2$)* | 24.4 ± 4.0 | 23.2 ± 4.6 | >0.05[a] |
| Co-morbidities | 28 (63.6) | 16 (36.4) | >0.05[b] |
| Pre-existing joint diseases | 9 (50) | 9 (50) | >0.05[b] |

*Data expressed mean ± standard deviation, [a]p-value derived using unpaired student's *t*-test: [b]p-value derived using Fisher's exact test, BMI: body mass index

**TABLE 2.** Clinical presentation and laboratory investigations.

| | No. of patients (%) | | p-value |
|---|---|---|---|
| | Open arthrotomy (n=44) | Arthroscopic (n=33) | |
| Onset (day)* | 18.7 ± 27.8 | 23.3 ± 33.1 | >0.05[a] |
| Affected knee | | | |
| Left knee | 22 (50.0) | 19 (57.6) | >0.05[b] |
| Right knee | 21 (47.7) | 13 (39.4) | |
| Both knees | 1 (2.3) | 1 (3.0) | |
| Blood, WBC count ($x10^9/L$)* | 12.1 ± 6.7 | 11.0 ± 4.1 | >0.05[a] |
| ESR (mm/hr)* | 94.8 ± 29.1 | 95.4 ± 23.2 | >0.05[a] |
| CRP (mg/L)* | 128.9 ± 103.3 | 127.6 ± 104.5 | >0.05[a] |
| Albumin (g/dl)* | 3.0 ± 0.8 | 3.2 ± 0.7 | >0.05[a] |
| Arthrocentesis (n=54) | | | |
| WBC ($x10^9/L$)* | 94.9 ± 89.3 | 64.2 ± 57.1 | >0.05[a] |
| PMN (%)* | 94.1 ± 4.4 | 95.2 ± 3.9 | >0.05[a] |

*Data expressed mean ± standard deviation, [a] p-value derived using unpaired student's *t*-test: [b] p-value derived using Fisher's exact test, WBC: White blood cell, ESR: Erythrocyte sedimentation rate, CRP: C-reactive protein, PMN: Polymorphonuclears cells

**TABLE 3.** Causative organisms isolated from knee joint fluid.

| Organisms | No. of patients (%) | |
|---|---|---|
| | Open arthrotomy (n=29) | Arthroscopic (n=17) |
| Streptococcus spp. | 12 (41.4) | 6 (35.3) |
| β-hemolytic *Streptococcus* group B | 1 (3.4) | 2 (11.7) |
| β-hemolytic *Streptococcus* not group A,B,D | 3 (10.3) | 2 (11.7) |
| *Streptococcus agalactiea* | 8 (27.6) | 1 (5.9) |
| *Streptococcus sanguinis* | - | 1 (5.9) |
| *Staphylococcus aureus* | 11 (37.9) | 6 (35.3) |
| *Salmonella* spp. | - | 1 (5.9) |
| *Escherichia coli* | 2 (6.9) | 1 (5.9) |
| *Klebsiella pneumonia* | 1 (3.4) | 1(5.9) |
| *Burkholderia pseudomellei* | 1 (3.4) | - |
| *Enterobacter clocae* | 1 (3.4) | - |
| *Pseudomonas aruginosa* | - | 1 (5.9) |
| *Aeromonas hydrophila* | 1 (3.4) | - |
| Others | - | 1 (5.9) |

## DISCUSSION

The limitation of this study was its design as a retrospective, medical record review study. Hence, the detailed clinical evaluations of preoperative and post-operative functions of the knee e.g., pain scoring, range of motion, and functional outcomes could not be retrieved. Furthermore, there was not enough information for long term follow up. However, there were a large number of patients in this study with a rather high positive culture rate. Furthermore, there was no such previous information available in the Thai population.

From our data, arthroscopic debridement significantly resulted in less blood loss and less post-operative complications than open arthrotomy. Our finding corresponded to the study of Sammer et al,[12] and others reports.[3,10,11] Their patients had fewer operations and a shorter hospital stay than did patients who had received open treatment. Additionally, it was reported that the advantages of arthroscopy, compared to the open arthrotomy, are better functional results and a decrease of morbidity.[10,11] It also has a high success ratio for eliminating infection, which was reported to be between 79% and 100%.[5,17-19]

Some surgeons might feel that arthroscopic debridement might not be an adequate surgery in subacute patients who already had thick pus and early fibrosis. The times between onset and definitive surgery in our patients were rather long with 18.7±27.8 days in the arthroscopic debridement group and 23.3±33.1 days in the open arthrotomy group. However, the immediate results of the surgery were similar. Therefore, arthroscopic debridement could provide adequate drainage and removal of infected tissues. In our study, arthroscopic debridement was successfully done in all cases, whereas only 95% success was achieved in open arthrotomy due to mortality in two patients. Furthermore, arthroscopic surgery allowed the surgeons better views of the posterior part of the knee and above the pica and shelf in the supra-patellar region.

Our data also revealed that *Streptococcus* and *Staphylococcus* were the two most common micro-organisms causing septic arthritis of the knee, corresponding to previous published series in Thailand.[3,14-16] We found the higher percentage of *Streptococcus* than *Staphylococcus* in septic arthritis of the knee which is consistent with that reported by Nilganuwong et al.[3] They reported 40.1% and 33.4% of Thai patients were infected with *Streptococcus* spp. and *Staphylococcus aureus*, respectively. Most *Streptococci* were more sensitive to the antibiotics used than *Staphylococci*. These findings might be a factor influencing our outcome which seemed to be better than some reports. *Staphylococci* were more commonly found in those reports.

**TABLE 4.** Operative details, length of hospital stay and complications.

| | No. of patients (%) | | p-value |
|---|---|---|---|
| | Open arthrotomy (n=44) | Arthroscopic (n=33) | |
| Operative time (min)* | 55.6±20.5 | 71.9±24.6 | <0.01[a] |
| Blood loss (ml)* | 51.5±63.8 | 18.1±16.6 | <0.01[a] |
| Blood replacement (unit)* | 2.1±1.2 | 2.4±1.7 | >0.05[a] |
| Length of stay (days)* | 27.4±21.3 | 25.3±13.7 | >0.05[a] |
| Post-operative complications | 21 (47.7) | 8 (24.2) | <0.05[b] |

*Data expressed mean ± standard deviation, [a]p-value derived using unpaired student's *t*-test: [b]p-value derived using Fisher's exact test

## CONCLUSION

Arthroscopic debridement is an effective treatment for the management of septic arthritis of the knee with has less blood loss and lower complication rates than open arthrotomy for treatment.

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### Conflict of interest

The authors confirm that there is no conflict of interest in the preparation of this article.

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