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Treatment of acute shoulder infection: can osseous lesion be a rudder in guideline for determining the method of débridement?

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Background: There is no standard to determine the most appropriate method of operation for the treatment of acute septic arthritis of the shoulder joint.
Methods: We retrospectively reviewed 57 patients who underwent arthroscopic or open débridement for acute shoulder infection between 2001 and 2015. Arthroscopic débridement was performed in 27 patients, and open débridement in 30 patients. According to the presence of bone erosion and/or marginal erosion of cartilage of the humeral head on plain radiographs and magnetic resonance imaging (MRI) images, the cases were classified into 3 groups (group 1, n = 23, without erosions in x-ray and MRI; group 2, n = 21, erosions seen in MRI but not in x-ray; and group 3, n = 13, with erosions seen in both x-ray and MRI).
Results: The arthroscopic group had a reinfection rate of 55.6% (15/27), and the open group had a reinfection rate of 16.7% (5/30). The reinfection rates in the arthroscopic and the open groups were 10% (1/10) and 15.4% (2/13) in group 1; 75% (9/12) and 11.1% (1/9) in group 2; and 100% (5/5) and 25% (2/8) in group 3, respectively. At the last follow-up, the mean University of California at Los Angeles score and the average time until normalization of white blood cell, erythrocyte sedimentation rate, and C-reactive protein in the open group showed superior results in the open group (all $P < .05$).
Conclusions: When preoperative MRI showed bone and/or cartilage erosion of humeral head, the reinfection rate after arthroscopic débridement was above 75%. Therefore, if preoperative MRI showed erosions, open débridement is more likely to be appropriate than arthroscopic débridement.
Level of evidence: Level III; Retrospective Cohort Comparison; Treatment Study

Keywords: Shoulder; infection; bone erosion; cartilage erosion; arthroscopic débridement; open débridement; reinfection

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Septic arthritis of the shoulder is an emergency with serious sequelae.[6] Most studies on septic arthritis of the shoulder focus on indolent infections from low-virulent organisms such as *Cutibacterium acnes*.[9,16] However, unlike indolent septic arthritis, the outcome in patients with acute septic arthritis due to more virulent organisms such as *Staphylococcus aureus* is poorer.[17] Although acute septic arthritis of the shoulder is not that common as an indolent septic arthritis, prompt and appropriate treatment to eliminate the infection is more critical as delayed or inadequate treatment can result in faster joint destruction due to more virulent organisms.[17]

The operative treatment options for septic arthritis of shoulder joint that have been reported previously are arthroscopic débridement,[1,5,8,10,12] open débridement (arthrotomy), and resection arthroplasty.[5,13,14] However, the superiority of and indications for each treatment method are still not clearly known, and most studies reported on the results of each surgical option.[1,10,14] Many studies have been published on septic arthritis of the knee joint as compared with the shoulder joint, and these studies have mentioned that arthroscopic débridement has a lower reinfection rate and is less invasive with more favorable clinical outcomes than open débridement; hence, arthroscopic débridement has become popular and is widely accepted as an effective surgical method for septic arthritis of the knee joint.[3,15] Meanwhile, in a study conducted by Bohler et al,[4] comparing arthroscopic débridement and open arthrotomy in septic arthritis of the shoulder joint, arthroscopic débridement was found to be unfavorable for septic arthritis of the shoulder joint. There was a higher reinfection rate in arthroscopic débridement than open débridement, which contradicted studies for the knee joint. While the knee joint is a hinge-like joint, the shoulder joint is anatomically different because it is a ball-and-socket joint with a subacromial space. Because of this anatomical difference, the reinfection rate of arthroscopic débridement for the septic shoulder joint has been reported to be around 30%, which is higher than that of the knee joint.[1,10]

Most studies follow the classification for septic arthritis by arthroscopic findings, which was established by Gächter.[19] This classification consists of 4 stages: stage I: opacity of fluid, redness of the synovial membrane, possible petechial bleeding, no radiological alterations; stage II: severe inflammation, fibrinous deposition, pus, no radiological alterations; stage III: thickening of the synovial membrane, compartment formation (''sponge-like'' arthroscopic view, especially in the suprapatellar pouch), no radiological alterations; stage IV: aggressive pannus with infiltration of the cartilage, possibly undermining the cartilage, radiological signs of subchondral osteolysis, possible osseous erosions and cysts. For septic arthritis of the shoulder joint at an early stage (Gächter stages I and II) or with early diagnosis, arthroscopic débridement is known to be effective.[2,10,19] However, as the recurrence rate is high in advanced stages or with delayed diagnosis, it has been reported that repeat arthroscopic débridement or open débridement is required to treat recurrent septic arthritis.[2,10,19] The reinfection rate was reported to be more than 50% especially for cases of Gächter stage IV, which has evidence of bone involvement on plain radiographs.[14,20] It indicated that the presence of bone involvement could negatively affect the results of arthroscopic débridement. Accordingly, guidelines to preoperatively determine the optimal surgical débridement method based on the presence of bone erosions are much needed to reduce the reinfection rate, but such studies have not been conducted yet.

Magnetic resonance imaging (MRI) is the most sensitive and noninvasive diagnostic tool that can observe joint effusion, synovial inflammation, bone marrow edema, cartilage loss, and bone erosion.[20,22] Therefore, identification of bone or cartilage involvement on preoperative MRI findings can assist in determining the proper treatment method before the operation.

The purpose of this study was to compare the efficacy of arthroscopic and open débridement in patients with acute shoulder infection and to determine whether bone or cartilage erosions can be a clue to determining the best method of operation. We hypothesized that the reinfection rate would be similar for arthroscopic débridement and open débridement in patients with acute shoulder infection. In addition, arthroscopic débridement was believed to be sufficient for patients without bone or cartilage erosions or with tiny bone or cartilage erosions on preoperative MRI. However, open débridement was believed to be necessary if radiographic evidence of bone invasion was present.

Materials and methods

Final approval of exemption from review by the Institutional Review Board was obtained because this study was retrospective in nature.

Patient selection

We retrospectively reviewed 67 patients (67 shoulders) who underwent surgical débridement at our clinic for acute septic arthritis of the shoulder joint between January 2001 and January 2015. All the patients in this study showed acute painful and swollen joint of the native joint rather than indolent infection. Ten cases with less than 2 years of follow-up were excluded, and a total of 57 cases were enrolled in the study. Thirty-one men and 26 women were included. The mean age at the time of operation was 55.6 years (range, 20-87 years), and the mean follow-up duration after the operation was 2.4 years (range, 2.0-8.6 years).

Among the 57 cases, 27 patients underwent arthroscopic débridement (arthroscopic group), whereas 30 patients underwent open débridement (open group). In the arthroscopic group, the mean follow-up duration after the operation was 2.3 years (2.0-7.8 years) in the arthroscopic

Table I Patient demographics between arthroscopic and open débridement

Variables	Arthroscopic (n = 27)	Open (n = 30)	*P* value
Age, y, mean age (range)	54.9 (22-76)	56.3 (20-87)	.683
Sex, male/female, n	12/15	19/11	.153
Etiology, n			
Hematogenous	9	11	.792
Intra-articular steroids	10	9	.574
Arthroscopic procedure	3	5	.709
Open procedure	2	3	.551
Acupuncture	3	2	.660
Underlying disease			
Diabetes	10	11	.977
Chronic liver disease	6	6	.837
Thyroid disease	1	0	.474
Renal failure	2	2	.653
Malignant tumor	1	1	.727

Table II Classification into 3 groups regarding bone erosion on x-ray or magnetic resonance imaging (MRI) and/or marginal erosion at the cartilage of the humeral head on MRI

Classification	Findings
Group 1 (n = 23)	Without erosions in x-ray and MRI
Group 2 (n = 21)	With erosions seen in MRI but not in x-ray
Group 3 (n = 13)	With erosions seen in both x-ray and MRI

group and 2.5 years (2.0-8.6 years) in the open group. Regarding the demographic data of the 2 groups, sex, mean age at the time of surgery, follow-up period, underlying disease, and etiology of infection were not statistically significant (Table I).

Preoperative radiologic evaluation

The mean time between x-rays, MRI, and surgery was 1.9 days (range, 0-3 days) and 1.7 days (range, 0–3 days), respectively. For radiologic assessment, x-rays were obtained using true AP (anterior to posterior), lateral scapular, and axial views. For MRI, a 3.0-T (Achieva; Philips Medical Systems, Eindhoven, The Netherlands) or 1.5-T (Signa; GE Healthcare, Chicago, IL, USA) imaging unit equipped with a dedicated shoulder coil was used. The following sequences were routinely obtained: axial fat-suppressed proton-density-weighted (PDW) (field of view [FOV], 140 × 140 mm; repetition time/echo time [TR/TE], 4200/30; flip angle, 90°; matrix, 320 × 240; section thickness, 2.0 mm; and intersection gap, 0.2 mm), axial turbo spin echo (TSE) T2-weighted (FOV, 140 × 140 mm; TR/TE, 3600-4000/80; matrix, 256 × 255; section thickness, 2.0 mm; and intersection gap, 0.2 mm), oblique coronal TSE T1-weighted (FOV, 140 × 140 mm; TR/TE, 500/10; matrix, 320 × 250; section thickness, 2.0 mm; and intersection gap, 0.5 mm), oblique coronal proton-density-weighted (FOV, 140 × 140 mm; TR/TE, 3500/30; matrix, 320 × 250; section thickness, 2.0 mm; and intersection gap, 0.2 mm), oblique coronal TSE T2-weighted (FOV, 140 × 140 mm; TR/TE, 3500-4000/80; matrix, 350 × 248; section thickness, 2.0 mm; and intersection gap, 0.2 mm), and oblique sagittal TSE T2-weighted (FOV, 140 × 140 mm; TR/TE, 5400-6000/80; matrix, 328 × 240; section thickness, 2.0 mm; and intersection gap, 0.5 mm), fat-suppressed gadolinium-enhanced T1-weighted axial and coronal (FOV, 140 × 140 mm; TR/TE, 540-580/10; matrix, 320 × 250; section thickness, 2.0 mm; and intersection gap, 0.2 mm). In some cases, axial T1-weighted, fat-suppressed T2-weighted coronal, or sagittal images were also obtained.

According to the presence of bone erosion on x-ray or MRI and/or marginal erosion at the cartilage of the humeral head on MRI, the cases were classified into 3 groups, and the reinfection rates of arthroscopic and open débridement within each group were compared (Table II). Bone erosion was defined as a cortical destruction on the humeral head on x-ray or MRI. The destruction of the cartilage of the humeral head including destruction near the bare area on MRI was defined as marginal erosion at the cartilage (Fig. 1). Group 1 included 23 patients without erosions in x-ray and MRI (Fig. 2); group 2 included 21 patients with erosions seen in MRI but not in x-ray (Fig. 3), and group 3 (Fig. 4) included 13 patients with erosions seen in both x-ray and MRI. Bone marrow edema on MRI was considered to be a reactive response and was not included as a bone erosion.[20,21]

Preoperative and postoperative evaluations

Initial evaluation included a medical history and a physical examination. Serologic markers, including differential white blood cell count, erythrocyte sedimentation rate, and C-reactive protein level, were routinely evaluated in all patients. The time (weeks) it took for serologic markers to normalize was also recorded. They were evaluated preoperatively and at each follow-up until the infection was controlled. Preoperative and postoperative subjective pain was assessed using a visual analog scale (VAS).[22] One senior surgeon assessed the range of motion including active forward elevation, external rotation at the side, posterior internal rotation, and abduction. We used the University of California and Los Angeles shoulder rating scale (UCLA) to measure shoulder function before and after surgery. The hospitalization period after surgery

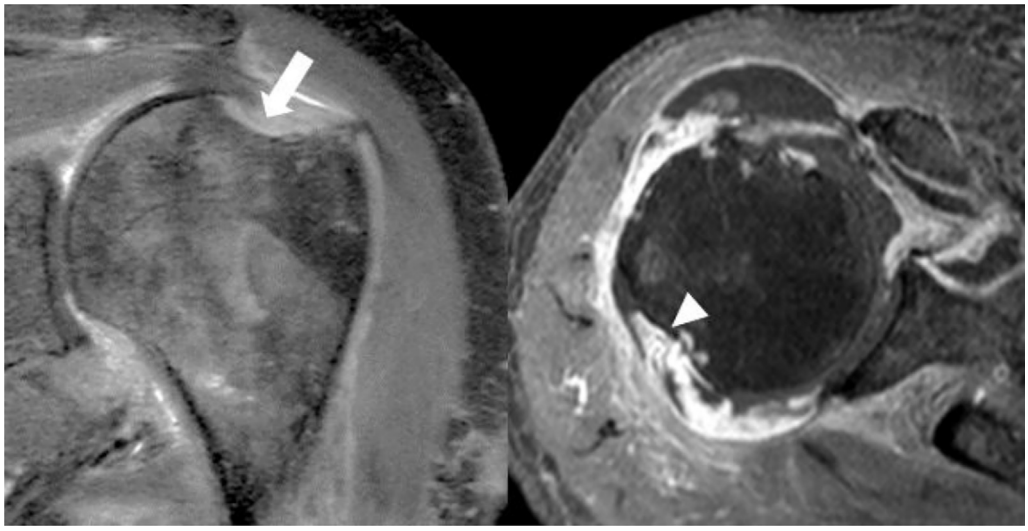

Figure 1 T1-weighted image of magnetic resonance imaging with spectral presaturation with inversion recovery after gadolinium injection: bone erosion (arrow) and marginal erosion at the cartilage of the humeral head (arrow head).

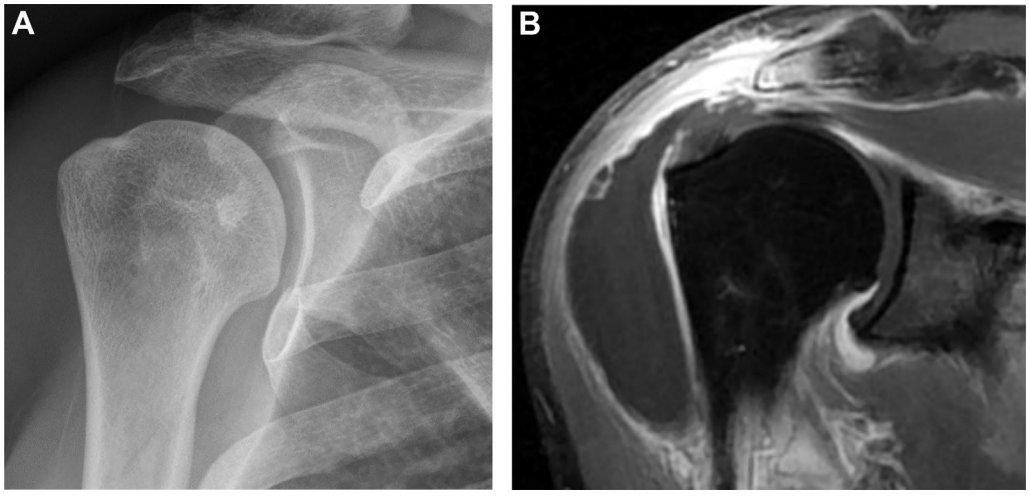

Figure 2 Radiograph and magnetic resonance imaging of group 1. (**A**) True anteroposterior view: normal finding. (**B**) T1-weighted coronal image with spectral presaturation with inversion recovery after gadolinium injection: marked edema of the surrounding extraosseous soft tissues and fluid collections without bony lesion.

included the sum of the days of hospitalization for initial operation and reoperation. All patients had standard shoulder radiographs and MRIs before surgery.

Operative techniques

All patients were placed in the beach-chair position. In arthroscopy, the glenohumeral joint and the subacromial space were identified. Meticulous débridement was performed to remove hypertrophied synovium and abnormal granulation tissue using 2 or 3 portals. In open débridement, the deltopectoral approach was used to expose the glenohumeral joint. Meticulous débridement of the glenohumeral joint and the subacromial space was performed with an extensive synovectomy and resection of infected bone and necrotic tissues. Multiple cultures and biopsies were taken, and the joint was washed with 6 liters of normal saline. After this lavage, the wound was closed with suction drains.

Postoperative treatment and rehabilitation

Rehabilitation varied from patient to patient, but generally, pendulum exercises started 2 weeks after débridement. The Hemovac was removed within 10 days when the total amount of drainage was less than 10 cc. At the beginning of the third week, passive forward flexion and abduction exercises were begun.

Postoperative antibiotic therapy varied from patient to patient; generally, the patients were treated with intravenous antibiotic therapy for 2 weeks after surgery, followed by oral

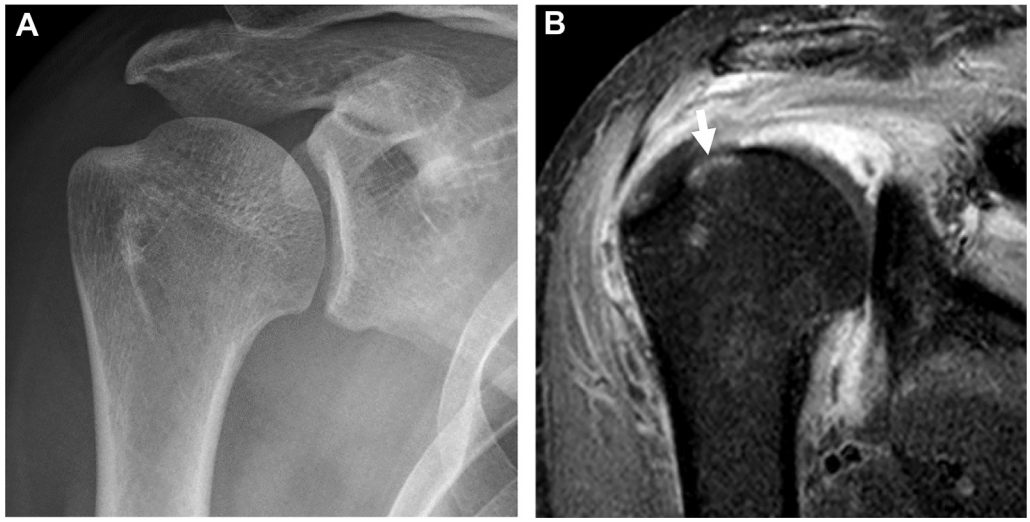

Figure 3 Radiograph and magnetic resonance imaging of group 2. (**A**) True anteroposterior view: normal finding. (**B**) T1-weighted coronal image with spectral presaturation with inversion recovery after gadolinium injection: synovial hypertrophy and fluid collection with bony erosion on the superior portion of the humeral head (white arrow).

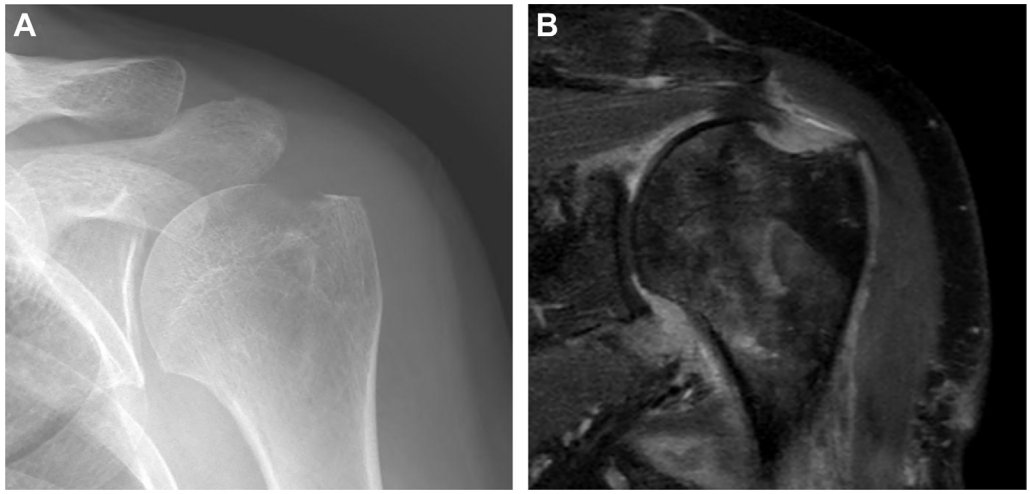

Figure 4 Radiograph and magnetic resonance imaging of group 3. (**A**) True anteroposterior view: bone erosion on the superior portion of the humeral head. (**B**) T1-weighted coronal image with spectral presaturation with inversion recovery after gadolinium injection: synovial hypertrophy, fluid collection, and bone marrow edema with bony erosion on the superior portion of the humeral head.

antibiotics for 4 weeks. The type of antibiotic, the duration of antibiotic administration, and the time to change from intravenous to oral antibiotics were determined by consultation with the infectious disease department.

Indications for reoperation

After surgical débridement, reinfection was diagnosed if the pain was not reduced and clinical signs of redness, swelling, warmth, and limited motion continued without a decrease in serologic markers (white blood cell, erythrocyte sedimentation rate, C-reactive protein) or pain, clinical signs, and serologic markers worsened again after normalization. Reoperation was performed for cases with reinfection.

Statistical analysis

The Mann-Whitney U test, χ^2 test, and Fisher exact test were performed to compare demographic variables and the results between the 2 surgical groups. The χ^2 test or the Fisher exact test was used to compare the reinfection rate between the arthroscopic and the open group. Significance was set at a level of .05 with associated 95% confidence intervals. The SPSS software package (version 21.0; IBM Corp, Armonk, NY, USA) was used for all statistical analyses.

Results

Reinfection rate related to bone or cartilage erosions and type of surgical débridement

Among the 27 patients in the arthroscopic group, 15 patients (55.6%) had reinfection, and 5 of the 30 patients (16.7%) in the open group had reinfection.

In group 1, there was no statistically significant difference in reinfection rate between the 2 groups. However, in groups 2 and 3, the reinfection rate was higher after arthroscopic débridement than open débridement (Table III). *S aureus* (8/20, 40%) was the most common organism causing reinfection (Table III). In group 3, all 5 cases that underwent arthroscopic débridement had tiny bone erosions on the humeral head on preoperative x-rays. Of the 8 patients who underwent open débridement, 3 patients had tiny bone erosions on the humeral head on x-rays, and infection was controlled in them. The remaining 5 patients had progressive bone loss, of whom 2 patients needed resection arthroplasty resulting in infection control.

Reinfection and reoperation

In the arthroscopic group, 11 of 15 patients underwent open débridement. Two patients underwent repeat arthroscopic débridement, but had a persistent infection that was controlled by open débridement. Resection arthroplasty was performed in the remaining 2 patients. Infection was controlled in all of the patients.

In the open group, repeat open débridement was conducted in all 5 patients, of whom 2 patients had persistent infection, and resection arthroplasty was performed. Infection was resolved in all of the patients.

Intraoperative microorganisms

In both arthroscopic and open groups, the most common organisms were methicillin-sensitive *S aureus* (29.6% and 33.3%, respectively). Cultures were negative for 7 shoulders (25.9%) in the arthroscopic group and 8 shoulders (26.7%) in the open group; however, all 15 shoulders had pus and acute inflammation on intraoperative pathology. Table IV shows intraoperative microorganism of the 2 groups.

Preoperative results

There was no statistically significant difference in the mean preoperative VAS score, UCLA score, range of motion, and serologic markers between the 2 groups. Table V provides detailed preoperative results of the 2 groups and corresponding *P* values.

Preoperative MRI findings

On preoperative MRI, joint effusion was observed in all except 2 cases, and synovial hypertrophy was observed in all except 1 case. On MRI examination, 23 patients had no bone or cartilage erosions, but 14 of 23 patients (60.7%) had bone marrow edema and 34 patients had bone or cartilage erosions, of whom bone marrow edema was seen in 32 patients (94.1%).

Postoperative results

For the mean VAS score, there was no statistical difference between the 2 groups. The open group showed significantly superior results in the UCLA score than the arthroscopic group. Active forward flexion and external rotation to the side were significantly higher after open débridement than arthroscopic débridement, but no statistically significant differences in posterior internal rotation and abduction between the 2 groups. The average time until normalization of these serologic markers and duration of hospitalization after surgery between the 2 groups were significantly longer after arthroscopic débridement than open débridement. Detailed postoperative results of the 2 groups and the corresponding *P* values are reported in Table VI.

Discussion

Arthroscopic débridement showed higher re-infection rate than open débridement for acute shoulder infection of the native joint (15/27, 55.6 % vs. 5/30, 16.7%). Furthermore, patients with bone or cartilage erosions on MRI had higher reinfection rate above 75% after arthroscopic débridement than open débridement.

Arthroscopic or open débridement for the treatment of acute shoulder infection is typically conducted as a surgical intervention.[4,11] However, there is still no guideline for determining the proper surgical method before the operation; hence, the choice is made based on the preference of the surgeon.[4,5]

Clinical signs such as redness, limited range of motion, serologic markers, aspirated joint fluid analysis, and culture can support a diagnosis of septic arthritis of the shoulder joint, but it cannot reflect the severity of the disease.[7,18] Plain radiographs at the advanced stage can show changes from joint space narrowing and bone destruction, but these are insensitive and nonspecific in the early stages.[20,21] Ultrasonography is useful for observing joint effusion and synovial hypertrophy, but it is difficult to observe osseous changes.[20,21] In addition, Gächter stage is a popular grading system used for septic arthritis of most joints, but it has the following limitations: (1) it cannot help determine the surgical method before the operation as the grading is based

Table III Reinfection rate related to bone or cartilage erosion and type of surgical débridement

	Arthroscopic reinfection (n)/Total (n)	Open reinfection (n)/Total (n)	*P* value
Group 1	1/10 (10%)	2/13 (15.4%)	.602
Organisms	MSSA (n = 1)	MSSA (n = 1)	
		S epidermidis (n = 1)	
Group 2	9/12 (75%)	1/9 (11.1%)	.008*
Organisms	MSSA (n = 2)	No growth (n = 1)	
	S epidermidis (n = 2)		
	P aeruginosa (n = 1)		
	Corynebacterium (n = 1)		
	MRSA (n = 1)		
	No growth (n = 2)		
Group 3	5/5 (100%)	2/8 (25%)	.021*
Organisms	MSSA (n = 1)	MRSA (n = 1)	
	P aeruginosa (n = 1)	No growth (n = 1)	
	MRSA (n = 1)		
	No growth (n = 2)		
Total	15/27 (55.6%)	5/30 (16.7%)	.002*

MSSA, methicillin-sensitive *Staphylococcus aureus*; *S*, staphylococcus; *P*, pseudomonas; *MRSA*, methicillin-resistant *Staphylococcus aureus*.
* Statistically significant ($P < .05$).

Table IV Intraoperative microorganism

	Arthroscopic (n = 27)	Open (n = 30)
MSSA	8	10
Staphylococcus epidermidis	6	6
Pseudomonas aeruginosa	2	2
Corynebacterium	2	1
MRSA	2	3
No bacterial growth	7	8

MSSA, methicillin-resistant *Staphylococcus aureus*; *MRSA*, methicillin-resistant *Staphylococcus aureus*.

on intra-articular findings, (2) stage classification is determined based on each surgeon's subjective findings, and (3) the boundaries between stages are unclear. On the other hand, MRI allows noninvasive and objective observation of joint effusion, synovial proliferation, bone marrow edema, cartilage loss, and bone erosion, which can be useful in the early detection and determination of the severity of septic arthritis of the shoulder joint.[20,21] As opposed to previous studies, group classification was made based on MRI findings, and reinfection rate related to the surgical method was analyzed to suggest that MRI is a useful diagnostic tool to determine the surgical method.[2,10,19]

A recent report by Bohler et al[4] is the only study that has compared the reinfection rate of arthroscopic and open débridement in septic arthritis of the shoulder joint. The authors reported a reinfection rate of 52.4% with arthroscopic débridement and that of 18.4% for open débridement, showing open débridement to be a more effective method.[4] Our study also found the reinfection rate in the arthroscopic group to be 55.6%, whereas that in the open group was 16.7%, showing comparable results with the study by Bohler et al.[4] The functional outcomes of the group that underwent arthroscopic débridement was worse than that of the group that underwent open débridement, and the duration of hospitalization after surgery and the average time to normalization of serologic markers were longer, likely because of the higher reoperation rate, as the reinfection rate was high in the arthroscopic group.

In the current study, the reinfection rate after arthroscopic débridement in patients with no bone or cartilage erosions on both preoperative x-rays and MRI images (group 1) was 10%, whereas open débridement resulted in 15.4% reinfection rate, showing no significant difference. However, for patients who had bone or cartilage erosions present on MRI but not on x-rays (group 2), arthroscopic débridement resulted in a reinfection rate of 75%, a relatively high rate, and when expanding the range to all patients showing bone or cartilage erosions on MRI (groups 2 and 3), the reinfection rate was 82% after arthroscopic débridement and 18% after open débridement, a statistically significant difference. In particular, all 5 patients (100%) in group 3 who were treated with arthroscopic débridement had reinfection.

From such findings, it seems that for patients without bone or cartilage erosions on preoperative MRI, the less invasive arthroscopic débridement seems to be a more favorable method compared with open débridement. But when bone or cartilage erosions are found on plain radiographs or MRI images, open débridement seems to be

Table V Differences of preoperative results between arthroscopic and open débridement

Variables (range)	Arthroscopic (n = 27)	Open (n = 30)	*P* value
Preoperative VAS	5.7 (4-8)	5.9 (4-9)	.469
Preoperative UCLA	15.3 (12-20)	14.8 (11-22)	.421
Preoperative range of motion			
Active forward flexion (°)	73.0 (20-140)	71.7 (30-140)	.716
External rotation at side (°)	15.4 (10-40)	15.0 (10-40)	.902
Internal rotation to back	L2 (Thigh-T10)	L3 (Thigh-T10)	.535
Abduction (°)	65.2 (30-90)	62.0 (20-90)	.434
Mean WBC count ($\times 10^3/mm^3$)†	12.375 (8.431-16.752)	11.542 (7.352-17.860)	.189
Mean ESR level (mm/h)†	63.2 (28-90)	59.2 (24-102)	.227
Mean CRP level (mg/L)†	7.86 (0.78-16.00)	7.67 (1.54-14.72)	.955

VAS, visual analog scale; *UCLA*, University of California at Los Angeles; *WBC*, white blood cell; *ESR*, erythrocyte sedimentation rate; *CRP*, C-reactive protein.

* Statistically significant ($P < .05$).

† Normal value: WBC $< 9.5 \times 10^3/mm^3$, ESR < 20 mm/h, and CRP < 0.3 mg/dL.

Table VI Differences of postoperative outcomes between arthroscopic and open débridement

	Arthroscopic (n = 27)	Open (n = 30)	*P* value
VAS	1.7 (0-4)	1.5 (0-4)	.551
UCLA score	24.2 (18-29)	28.4 (19-31)	.000*
Hospitalization (week)	2.8 (1-5.4)	1.7 (1-5.6)	.000*
Time to normalization (week)			
WBC count	2.8 (0.4-5.3)	1.7 (0.4-5.3)	.000*
ESR level	9.5 (0.4-25.4)	6.1 (0.4-25.7)	.009*
CRP level	7.3 (0.4-9.6)	3.7 (0.4-8.5)	.001*
Range of motion			
Active forward flexion (°)	118.5 (70-160)	133.7 (70-170)	.013*
External rotation at side (°)	20.4 (10-60)	30.7 (10-70)	.010*
Internal rotation to back	T11 (L5-T5)	T11 (L5-T5)	.705
Abduction (°)	91.9 (70-120)	95.0 (70-120)	.447

VAS, visual analog scale; *UCLA*, University of California at Los Angeles; *WBC*, white blood cell; *ESR*, erythrocyte sedimentation rate; *CRP*, C-reactive protein.

* Statistically significant ($P < .05$).

better than arthroscopic débridement if the infectious source in erosions cannot be eradicated by arthroscopic débridement. Jeon et al[10] analyzed 19 patients with septic arthritis of the shoulder joint who underwent arthroscopic débridement based on Gächter stage and found that 4 of 17 patients (23.5%) who belonged to stage I, II, or III were reinfected, and 1 of 2 patients (50%) who belonged to stage IV had reinfection. Therefore, Jeon et al[10] stated that arthroscopic débridement could fail if bone or cartilage erosions are found on preoperative MRI. However, this study included only 2 patients at stage IV; therefore, their findings are limited by a lack of statistical significance.

The limitations of this study are that it was a retrospective study with few subjects in each group; thus, the statistical significance may be small. However, studies on septic arthritis of the shoulder joint only are scarce, and thus it is valuable as a first study to suggest a guideline for determining the method of surgical débridement in septic arthritis of the shoulder joint using preoperative imaging modalities.

Conclusion

Without bone or cartilage erosions on preoperative MRI, there was no significant difference in reinfection rate between arthroscopic and open débridement. On the other hand, even if the lesion was very tiny, bone or cartilage erosions on MRI resulted in a very high reinfection rate for arthroscopic débridement. Therefore, for the surgical treatment of septic arthritis of the shoulder joint, the presence of bone or cartilage erosions can be a critical clue in determining the proper surgical method, and for this reason, identifying the presence of bone or

cartilage erosions with preoperative MRI is believed to be necessary and can be one additional element to prefer open débridement.

Disclaimer

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