Concomitant Septic Arthritis of the Hip in Patients with Osteonecrosis of the Femoral Head

Young-Kyun Lee, MD, PhD
Orthopedic Surgeon, Associate Professor

Seokhyung Won, MD
Orthopedic Surgeon, Clinical and Academic Fellow

Jiung Yeom, MD
Orthopedic Surgeon, Clinical and Academic Fellow

Jung Wee Park, MD
Orthopedic Surgeon, Clinical and Academic Fellow

Seok Min Lim, MD
Orthopedic Surgeon, Clinical and Academic Fellow

Jin Woo Im, MD
Orthopedic Surgeon, Clinical and Academic Fellow

Kyung-Hoi Koo, MD, PhD
Orthopedic Surgeon, Professor
Department of Orthopedic Surgery
Seoul National University College of Medicine

Seoul National University Bundang Hospital, Seongnam, South Korea

ABSTRACT

Introduction: Septic hip is a rare condition and is known to occur in immune-compromised patients. In general, surgeons are not concerned about the superimposed septic hip when they operate on patients with osteonecrosis of the femoral head (ONFH) if the patient is not immune compromised.

We evaluated 1) the proportion of septic arthritis among patients with ONFH, 2) the clinical and laboratory features, and 3) the outcomes of two-stage THA in those patients.

Materials and Methods: We identified patients who were diagnosed as having concomitant septic arthritis of the hip among 1,226 patients who underwent THA due to ONFH from 2011 to 2018 at our institution. A diagnosis of septic arthritis was made by aspirated joint fluid; white blood cell (WBC) count >15,000/ml and neutrophils >75%, microbiological culture, and/or the findings of septic arthritis on magnetic resonance imaging (MRI) scan. Osteonecrotic patients with infection were treated with two-stage THA.

Results: Among the 1,226 osteonecrotic patients, 14 (1.1%) had concomitant septic arthritis of the hip. There were nine men and five women. None of them were immune compromised or had a remote septic focus. In
Although septic arthritis of the hip is a rare condition, it results in serious destruction and functional damage of the joint. Septic arthritis has been known to occur mainly in immune-compromised patients, such as systemic lupus erythematosus (SLE) patients, drug abusers, or organ transplant patients.

The reported incidences of septic arthritis are 2-5/100,000/year in the general population, 28-38/100,000/year in patients with rheumatoid arthritis, and 40-68/100,000/year in patients with joint prostheses.

The clinical presentation of septic arthritis of the hip, and that of osteonecrosis of the femoral head (ONFH), might be similar, and preoperative diagnosis of the superimposed septic arthritis is difficult when an ONFH patient is immune-competent. When surgeons plan total hip arthroplasty (THA) for ONFH patients, they are not concerned with the superimposed infection.

The purpose of our study was to evaluate 1) proportion of septic arthritis among ONFH patients, 2) clinical and laboratory features of these patients, and 3) outcomes of two-stage THA.

**INTRODUCTION**

Although septic arthritis of the hip is a rare condition, it results in serious destruction and functional damage of the joint. Septic arthritis has been known to occur mainly in immune-compromised patients, such as systemic lupus erythematosus (SLE) patients, drug abusers, or organ transplant patients.

The reported incidences of septic arthritis are 2-5/100,000/year in the general population, 28-38/100,000/year in patients with rheumatoid arthritis, and 40-68/100,000/year in patients with joint prostheses. The clinical presentation of septic arthritis of the hip, and that of osteonecrosis of the femoral head (ONFH), might be similar, and preoperative diagnosis of the superimposed septic arthritis is difficult when an ONFH patient is immune-competent.

When surgeons plan total hip arthroplasty (THA) for ONFH patients, they are not concerned with the superimposed infection.

**MATERIALS AND METHODS**

We retrospectively reviewed medical records of 1,226 patients who underwent THA due to ONFH at a tertiary referral hospital from January 2011 to December 2018 to identify patients who had superimposed septic arthritis of the hip.

We evaluated patient symptoms such as fever, preoperative laboratory examination including erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), preoperative magnetic resonance imaging (MRI), joint fluid aspiration, intraoperative frozen section of synovium, culture study, risk factors for

**Table I**

Clinical characteristics of 14 osteonecrotic patients with septic arthritis of the hip

<table>
<thead>
<tr>
<th>Case</th>
<th>Age/Gender</th>
<th>Risk factor</th>
<th>Fever</th>
<th>MRI</th>
<th>WBC</th>
<th>PMN%</th>
<th>ESRβ</th>
<th>CRPγ</th>
<th>Joint fluidδ</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38/M</td>
<td>Alcohol</td>
<td>+</td>
<td>-</td>
<td>4.8</td>
<td>95</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>51/M</td>
<td>Alcohol</td>
<td>+</td>
<td>-</td>
<td>8</td>
<td>67</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>S. lugdunensis</td>
</tr>
<tr>
<td>3</td>
<td>61/M</td>
<td>Alcohol</td>
<td>+</td>
<td>-</td>
<td>7.8</td>
<td>62</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>Coagulase (-) Staphylococcus</td>
</tr>
<tr>
<td>4</td>
<td>80/M</td>
<td>Alcohol</td>
<td>+</td>
<td>-</td>
<td>3.8</td>
<td>74</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>60/F</td>
<td>Alcohol</td>
<td>-</td>
<td>-</td>
<td>10.5</td>
<td>76</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>60/M</td>
<td>Alcohol</td>
<td>+</td>
<td>-</td>
<td>6.6</td>
<td>54</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>74/F</td>
<td>Hip fracture</td>
<td>+</td>
<td>-</td>
<td>9.9</td>
<td>61</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>30</td>
</tr>
<tr>
<td>8</td>
<td>47/F</td>
<td>Alcohol</td>
<td>+</td>
<td>-</td>
<td>6.1</td>
<td>55</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>60/F</td>
<td>Hip fracture</td>
<td>-</td>
<td>-</td>
<td>12.8</td>
<td>76</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>61/F</td>
<td>Hip fracture</td>
<td>+</td>
<td>-</td>
<td>7.3</td>
<td>58</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>50</td>
</tr>
<tr>
<td>11</td>
<td>80/F</td>
<td>Hip fracture</td>
<td>+</td>
<td>-</td>
<td>10.2</td>
<td>80</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>S. agalactiae (Group B)</td>
</tr>
<tr>
<td>12</td>
<td>44/M</td>
<td>Alcohol</td>
<td>+</td>
<td>-</td>
<td>4.3</td>
<td>78</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>20</td>
</tr>
<tr>
<td>13</td>
<td>48/M</td>
<td>Alcohol</td>
<td>+</td>
<td>-</td>
<td>6</td>
<td>61</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>20</td>
</tr>
</tbody>
</table>

α: Fever >37.5°C, β: ESR >20mm/hr, γ: CRP >0.5mg/dL, δ: WBC count >15,000/ml and neutrophils >75%, ε: number of PMN on frozen section of synovium
A diagnosis of septic arthritis was made by 1) analysis of aspirated joint fluid; white blood cell (WBC) count (>15,000/ml) and percentage of neutrophils (>75%) of joint fluid, 2) microbiological culture, and/or 3) the findings of septic arthritis on MRI scan.

MRI findings that were considered as positive for septic arthritis include an increase of joint effusion, presence of synovial thickening, alterations in signal intensity of bone marrow of both proximal femur and acetabulum, and soft tissue around the hip joint with strong enhancement.

Seven patients underwent ultrasound and 11 patients had an MRI scan of the hip preoperatively. Intraoperative aspiration of the joint fluid was attempted in all patients. Synovial tissue was sent to the pathologic department for frozen and permanent sections.

All patients were treated with two-stage arthroplasty: resection arthroplasty (two patients) or antibiotic-cement insertion (12 patients) followed by second-stage cementless THA. The second-stage arthroplasty was done after ESR and CRP levels normalized and clinical symptoms of infection subsided. All operations were done by three high-volume (>100 hip surgeries/year) hip surgeons.

RESULTS

Among the 1,226 osteonecrotic patients, 14 patients (1.1%) were diagnosed with concomitant septic arthritis of the hip. Nine patients were male and five patients were female, and their mean age was 58 years (range, 44 to 80 years). Ten patients had bilateral ONFH.

None of the patients were immune compromised. Risk factors of ONFH included alcohol abuse in eight patients, previous hip fracture in two, and unidenti
died in four (Table I).10,11

Among the seven patients who underwent ultrasound-guided aspiration, a sufficient amount of joint fluid for cell count and culture was aspirated in two patients. In these two patients, WBC
count was >15,000/ml and the percentage of neutrophil was >75%. The findings of septic arthritis were seen in 11 of the 12 patients who had preoperative MRI scan, and pus was aspirated in four patients during the operation. Microorganism was identified in three hips: Staphylococcus lugdunensis, Coagulase negative staphylococcus, and Streptococcus agalactiae (Group B).

Median ESR and CRP values were 39 mm/1hr (range, 13 to 69 mm/1hr) and 3.7 mg/dl (range, 0.3 to 16 mg/dl), respectively. All patients had pathologic findings of chronic active inflammation with synovial hyperplasia and neutrophil aggregates.

Second-stage total hip arthroplasty was done six to 12 weeks after the first-stage procedure with ceramic-on-ceramic bearing (Biolox delta; CeramTec, Plochingen, Germany) and cementless prostheses. Patients were followed for one to seven years after the second-stage reconstruction. No patient had evidence of periprosthetic joint infection at the latest follow up (Figs. 1a–c and 2a–d).

**DISCUSSION**

Total hip arthroplasty is a successful surgical procedure for advanced ONFH. Because septic arthritis usually occurs in immunocompromised patients, surgeons are not concerned about the superimposed septic hip when they do THA in ONFH patients. In our study, 14 (1.1%) of the 1226 patients who underwent THA due to ONFH had concomitant septic arthritis of the hip.

Previously, two studies reported cases of septic arthritis combined with ONFH. However, in these studies, most patients were immunocompromised due to SLE, organ transplantation, or history of intravenous drug abuse. In our study, no patient was immunocompromised and no patient had any risk factor of hematogenous infection.

Various criteria have been suggested for the diagnosis of septic arthritis, and positive bacterial culture is a critical standard. In our study, microorganisms were identified in only three patients. We adopted several criteria including MRI criteria for the diagnosis of septic arthritis of the hip, because conventional culture methods have a low sensitivity, especially after the use of antibiotics. Our patients were scheduled for elective primary THA, and they had a preventive antibiotic 30 minutes before the operation. MRI is highly sensitive in the detection of septic arthritis of the hip. In our study, a diagnosis of septic arthritis was made in 11 patients by MRI findings.

Some authors suggested that preoperative CRP and ESR have higher sensitivity and specificity for the diagnosis of septic arthritis in patients undergoing joint arthroplasty. In our institution, we recommend preoperative ultrasound and/or MRI when there is a suspicion of septic arthritis.

Frozen biopsy of synovium has a high reliability to identify active infection, and this procedure has been recommended during surgery to detect low-grade or spurious infection. In our study, all of the 14 patients had a Polymorphonuclear (PMN) count >10 HPF in synovial frozen section.

We note several limitations. First, our study is a case series and has no control group. It cannot statistically assess whether ONFH is a risk factor for septic arthritis of the hip.

Second, we could not find risk factors of infection in the osteonecrotic hip because the sample size was small. Third, our data was collected from a single tertiary center, and there might be a potential for referral bias.

**CONCLUSION**

In our study, the incidence of septic arthritis associated with ONFH was 1.1%. When ONFH patients have an unexplained elevation of ESR and/or CRP, superimposed septic arthritis should be suspected. We recommend ultrasound and/or MRI to confirm the presence of infection in these patients.

**AUTHORS’ DISCLOSURES**

The authors have no conflicts of interest to disclose.

Young-Kyun Lee and Seokhyung Won contributed equally to this study and should be considered as co-first authors.

**REFERENCES**