Percutaneous drainage and continuous irrigation in patients with severe pyogenic spondylitis, abscess formation, and marked bone destruction

**Objective.** The use of percutaneous suction aspiration has recently become viewed as an effective management strategy for pyogenic spondylitis unresponsive to conservative treatment. What remains unclear is whether it can be effective for severe pyogenic spondylitis in which abscess formation or marked bone destruction is present. The authors undertook a study to clarify answers to this question.

**Methods.** The authors evaluated clinical and radiographic/neuroimaging data obtained in five patients with severe pyogenic spondylitis, extensive abscesses, and marked bone destruction. These patients had undergone percutaneous drainage and continuous irrigation because open surgery was considered contraindicated in light of their poor general health. The mean period during which continuous irrigation was applied was 9 days (range 7–11 days), and the mean period during which the drainage tube was in place was 19 days (range 13–38 days). All patients suffered from back pain, which was relieved by the percutaneous technique in four patients after a mean of 8 days. The abscesses and inflammation resolved in all patients. Progressive osseous destruction was not observed, and open surgery was performed in only one patient in whom back pain persisted as a result of spinal instability.

**Conclusions.** After an unsuccessful course of conservative treatment, severe pyogenic spondylitis with abscess formation or marked bone destruction was successfully treated using percutaneous drainage and continuous irrigation. Based on their results, the authors believe that this procedure can be used in patients with severe pyogenic spondylitis that was unresponsive to conservative treatment, particularly in those whose general health is poor.

**Key Words** • pyogenic spondylitis • abscess • lumbar spine • percutaneous drainage • continuous irrigation

**Abbreviations used in this paper:** ADL = activities of daily living; CRP = C-reactive protein; MR = magnetic resonance; MRSA = methicillin-resistant *Staphylococcus aureus*; VB = vertebral body.
Percutaneous drainage for severe pyogenic spondylitis

ducted for 5 to 19 weeks in four patients, and three open surgeries had been performed in one patient. Health status had not been improved by these treatments in any patient. The onset of pyogenic spondylitis was classified according to the criteria of Kulowski as acute in three patients and insidious in two. The affected vertebral segments were L1–2 in two patients, L3–4 in two, and L4–5 in one. All patients reported back pain, and this was severe enough in four patients that they could not stand or walk. Radicular pain was present in four patients. Neurological deficits such as muscle weakness or bowel/bladder dysfunction were absent in all cases. Complications included diabetes mellitus in one patient, liver cirrhosis in one, and chronic respiratory failure due to pneumoconiosis in one. Radiographically documented bone destruction stages, clarified using the scheme of Griffiths and Jones, was early stage (narrowing of disc space) in one patient and destructive stage (bone destruction, collapse of softened vertebrae, and bone proliferation) in four patients; the healing stage was observed in no patient. Destruction of the VB including its posterior aspect without kyphosis was observed in three of the four patients with destructive-stage bone defects, and deformity with kyphosis was observed in the remaining patient with a destructive-stage bone defect. Magnetic resonance imaging revealed psoas muscle abscesses in three patients and epidural abscesses in three. The mean follow-up period was 23.8 months (range 20–29 months). Three patients were examined by one of the authors, whereas the other two patients (who lived too far away) and their primary physicians were contacted by telephone to acquire clinical follow-up information (Table 1).

Surgical Technique

The patient was positioned prone on the operating table. It is necessary to obtain clear anteroposterior and lateral fluoroscopic images to perform the procedure safely. Using a K-wire as a guide, a dilator was inserted obliquely through a small skin incision after application of a local anesthetic; the dilator was directed toward the disc space to create a surgical space. A No. 14 French drainage tube was inserted through the dilator into the disc space for the inflow of the irrigation. Using the same method, another drainage tube was inserted into the same disc space from the other side for the outflow of liquid (Fig. 1). The disc space was irrigated with normal saline. Drained tissue was sent for culturing. Postoperatively, continuous irrigation was performed with normal saline for approximately 7 days until the fluid being drained was clear. The rate of irrigation was maintained at 80 ml/hour. After continuous irrigation was discontinued, the drainage tube was left in place for dependent drainage. If the culture of the fluid sample was sterile, the drainage tube was removed several days later depending on the amount of fluid drained. Patients also received intermittent intravenous or peroral antibiotic medication until remission of inflammation was confirmed by the relief of back pain and decreases in levels of CRP to less than 0.5 mg/dl.

Postoperative Evaluation

The criteria for the evaluation have been previously reported. We used the following categories for evaluation: excellent, no limitation in ADL and no pain; good, no limitation in ADL but occasional mild pain; fair, slight limitation in ADL with persisting pain that was not as great as that before surgery; and poor, limitation in ADL and persistent marked pain.

Results

The mean period from onset of symptoms to surgery was 18 weeks (range 5–52 weeks). The mean duration of continuous irrigation was 9 days (range 7–11 days), and the mean period during which the drainage tube remained in place was 19 days (range 13–38 days). Intravenously administered antibiotic agents were continued for a mean of 30 days (range 17–49 days), and the administration of peroral antibiotic agents was continued for a mean of 59 days (range 0–180 days) until remission was confirmed by relief of back pain and decreasing CRP levels. Causative organisms were isolated in four patients: Pseudomonas aeruginosa in one patient, MRSA in two, and Bacteroides fragilis in one. Although the source of the infection could not be confirmed in any patient, we speculated that the source was a laceration of the hand in one patient and the respiratory tract in another. No complications, neurological or otherwise, resulted from the procedure.

The back pain that was present in all cases was relieved by the surgical intervention in four patients after a mean of 8 days (range 3–11 days). Back pain persisted in a 72-year-old man (Case 2) with pyogenic spondylitis of the L3–4 intervertebral disc space. He had undergone open surgery three times at another hospital during the previous 12 months. The patient’s general condition was considered to be severe and thus to represent a poor risk for major surgery. Radiography demonstrated marked bone destruction (Fig. 2 upper left) and MR imaging revealed abscesses in the disc space and psoas muscle (Fig. 2 upper right and lower left). The abscesses were resolved by Day 17 after percutaneous drainage and continuous irrigation (Fig. 2 lower right). Because he continued to complain of back pain due to spinal instability, we conducted spinal fixation by placing an anterior autologous bone graft 30 days after discontinuing the percutaneous drainage and continuous irrigation protocol. At this time, the patient’s general condition had been improved by the percutaneous drainage, and we considered him a suitable candidate for major surgery. The fixation procedure yielded a good result. Radicular pain was present in four patients, and it was also relieved in all patients by the time the drainage tubes were removed.

The mean preoperative CRP level was 11.7 mg/dl (range 1.8–35.7 mg/dl), whereas at a mean of 12 weeks (range 2–23 weeks) it had decreased to less than 0.5 mg/dl in four patients. The CRP levels remained slightly elevated in one patient because of chronic respiratory infection. Using ultrasonographic guidance, an additional drainage tube was inserted into psoas muscle abscesses intraoperatively in two of the three patients in whom MR imaging had documented these lesions (Cases 1 and 2), and all psoas and epidural abscesses were resolved by the time the drainage tubes were removed from the disc space.

At the final follow-up examination, radiographic studies revealed bone fusion in the patient who had undergone...
anterior autologous bone graft–assisted fixation, better definition of the vertebral endplates in one patient, and bridging callus and sclerosis in three patients. Progressive destructive changes and increased kyphosis were absent in all cases. Neurological deficit did not develop in any case. At final follow-up examination, the clinical outcomes were excellent in two patients and good in the remaining three (Fig. 3).

Discussion

In all patients in this series conservative treatment failed to resolve symptoms and an extensive abscess or marked bone destruction was observed. Patients in such a condition have traditionally been treated using open surgery.

In 1989, Emery and associates' reported outcomes after surgical debridement and the placement of anterior autologous bone grafts in 21 patients with pyogenic vertebral osteomyelitis. They described the indications for surgery as the following: neurological deficit in six patients, failure of medical treatment in three, destruction of approximately 50% of a VB in two, and the need to obtain specific culture data in 10. In 1991, Wisneski described the indications of open surgery as the following: 1) increased osseous involvement; 2) increased paraspinal abscess formation; 3) neurological deficit; 4) failure to respond to conservative therapy; 5) failure of needle biopsy sampling to obtain necessary culture material; and 6) deformity with or without incapacitating spinal pain. Wisneski also considered laminectomy to be contraindicated, except in the setting of epidural abscess formation, because adequate debridement could not be achieved via the posterior approach. In 1990, Lifeso reported the outcomes obtained in 20 patients who underwent spinal decompression to treat pyogenic spinal sepsis; in 11 of these patients that procedure was combined with anterior autologous bone graft–augmented fusion. He contended that pain relief, spinal stabilization, and neural decompres-

<table>
<thead>
<tr>
<th>Variable</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
<th>Case 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>age (yrs)</td>
<td>70</td>
<td>72</td>
<td>91</td>
<td>66</td>
<td>81</td>
</tr>
<tr>
<td>level of lesion</td>
<td>L1–2</td>
<td>L3–4</td>
<td>L1–2</td>
<td>L3–4</td>
<td>L4–5</td>
</tr>
<tr>
<td>treatment until op</td>
<td>conservative</td>
<td>none</td>
<td>none</td>
<td>conservative</td>
<td>conservative</td>
</tr>
<tr>
<td>(duration)</td>
<td>(5 wks)</td>
<td>none</td>
<td>(7 wks)</td>
<td>(5 wks)</td>
<td>(19 wks)</td>
</tr>
<tr>
<td>wks from onset to op</td>
<td>5</td>
<td>52</td>
<td>7</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>radiographic stage†</td>
<td>early</td>
<td>destructive</td>
<td>destructive w/ kyphosis</td>
<td>destructive</td>
<td>destructive</td>
</tr>
<tr>
<td>abscess</td>
<td>psoas &amp; epidural</td>
<td>psoas</td>
<td>psoas &amp; epidural</td>
<td>epidural</td>
<td>none</td>
</tr>
<tr>
<td>neurological deficits</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>culture</td>
<td>B. fragilis</td>
<td>MRSA</td>
<td>TW</td>
<td>unknown</td>
<td>MRSA</td>
</tr>
<tr>
<td>source</td>
<td>NC</td>
<td>NC</td>
<td>RT</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>preop CRP (mg/dl)</td>
<td>11.2</td>
<td>5.1</td>
<td>1.8</td>
<td>4.7</td>
<td>35.7</td>
</tr>
<tr>
<td>wks of CRP &lt; 0.5 mg/dl</td>
<td>15</td>
<td>8</td>
<td>2</td>
<td>slightly elevated due to CRTI</td>
<td>23</td>
</tr>
<tr>
<td>radiographic outcome</td>
<td>better definition of endplates</td>
<td>fusion</td>
<td>bridging callus &amp; sclerosis</td>
<td>bridging callus &amp; sclerosis</td>
<td>bridging callus &amp; sclerosis</td>
</tr>
<tr>
<td>clinical outcome</td>
<td>excellent</td>
<td>good</td>
<td>excellent</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>FU (mos)</td>
<td>20</td>
<td>29</td>
<td>22</td>
<td>22</td>
<td>26</td>
</tr>
</tbody>
</table>

* CRTI = chronic respiratory tract infection; FU = follow up; NC = not confirmed; RT = respiratory tract; TW = traumatic wound.
† Stages described in the classification scheme reported by Griffiths and Jones.

**Fig. 1.** Left: Schematic illustrating the percutaneous drainage and continuous irrigation technique. A No. 14 French drainage tube is inserted through the dilator into the disc space. Using the same method, another drainage tube is inserted into the same disc space from the contralateral side. Right: Axial computerized tomography scan obtained after the procedure, showing the No. 14 French tubes for inflow and outflow (suction drainage).
Percutaneous drainage for severe pyogenic spondylitis

Fig. 2. Case 2. Imaging studies obtained in a 72-year-old man with pyogenic spondylitis of the L3–4 intervertebral disc space. He had undergone three open surgeries at another hospital. Upper Left: Radiograph showing marked bone destruction. Upper Right and Lower Left: Preoperative MR images revealing abscesses in the disc space and psoas muscle. Lower Right: Postoperative MR image obtained 17 days after percutaneous draining and drainage of psoas abscess, demonstrating remission of the lesions. Because the patient continued to suffer from back pain due to instability, we conducted anterior bone graft–augmented fusion. The postfusion result was good.
tion of antibiotic agents, in addition to percutaneous suction aspiration, in 23 patients with pyogenic spondylitis. Outcomes were excellent in 13 patients, good in eight, fair in one, and poor in one. Bone grafts were not placed after debridement in this procedure, and spontaneous fusion was obtained in only nine patients, but instability or marked kyphotic changes were not observed in the affected spines. Nagata, et al., indicated that the main advantages of the technique were its reduced invasiveness compared with the open surgery, and the almost immediate symptomatic relief it provided. Indications for the technique were considered to include the following: 1) no improvement in the condition of the patient despite use of antibiotic agents and immobilization for at least 1 month; 2) the presence of only a single affected intervertebral disc; 3) the location of the involved vertebra in the lower thoracic or lumbar spine; 4) the absence of any major neurological deficit; and 5) the absence of radiographically documented marked destructive changes in the affected VB. The procedure failed to improve symptoms in one patient in whom marked destructive changes were apparent on radiography, and open surgery involving the implantation of an anterior bone graft was subsequently performed. The procedure was considered effective for early-stage pyogenic spondylitis.

In the present series, conservative treatment had failed in all patients. Open surgery was considered too risky because the patients were in poor general health. Thus percutaneous surgery was performed despite the presence of radiographically documented significant destructive changes in four patients and MR imaging evidence of abscesses in four pa-

Fig. 3. Case 5. Imaging studies acquired in an 81-year-old man with pyogenic spondylitis of the L4–5 intervertebral disc space.  
Upper Left: Lateral radiograph showing marked bone destruction.  
Upper Center: Sagittal MR image revealing an abscess in the disc space.  
Upper Right and Lower Left: Lateral radiographs obtained after the operation.  
Lower Center: Sagittal MR image obtained 20 days postoperatively, demonstrating absence of the abscess.  
Lower Right: Lateral radiograph acquired 1 year after the surgery, showing no progressive bone destruction.
Percutaneous drainage for severe pyogenic spondylitis

tients. Remission of inflammation was evident in all pa-
tients, and all psoas muscle and epidural abscesses were
resolved. No complications resulted from percutaneous
surgery, but clear anteroposterior and lateral fluoroscopic
images are necessary to avoid injury of the abdominal aorta
and intestine. Although the percutaneous technique is asso-
ciated with a potential risk of neurological complications, it
can be performed after application of a local anesthetic, al-
lowing patients to articulate the onset of radicular pain and
thus helping to avoid neurological complications. Complic-
ations associated with irrigation of the space adjacent to
the spinal canal did not occur in any case, and such compli-
cations were also avoided in the only report about continu-
ous irrigation for pyogenic spondylitis.1

The aforedescribed technique can be used as a salvage
therapy in patients with severe pyogenic spondylitis that is
unresponsive to conservative treatment, particularly in pa-
tients in poor general condition. Progressive osseous de-
struction was not observed in any case, and open surgery
was performed in only one patient with persisting back pain
due to vertebral instability. Open surgery is not always nec-
necessary in cases unresponsive to conservative treatment; its
need can be determined after conducting the aforemen-
tioned procedure. The indications for open surgery can thus
be reduced.

Conclusions

Percutaneous drainage and continuous irrigation were
effective even in cases involving severe pyogenic spondy-
litis, abscess formation, and marked bone destruction that
were unresponsive to conservative treatment. Our findings
suggested that this technique can be considered a salvage
treatment in patients with severe pyogenic spondylitis in
whom conservative treatment has failed, particularly in pa-
tients in poor general health.

References
1. Emery SE, Chan DPK, Woodward HR: Treatment of hema-
togenous pyogenic vertebral osteomyelitis with anterior de-
2. Gebhard JS, Brugman JL: Percutaneous discectomy for the treat-
A review of twenty-eight cases. J Bone Joint Surg Br 53:
383–391, 1971
4. Jeanneret B, Margel F: Treatment of osteomyelitis of the spine
using percutaneous suction/irrigation and percutaneous external
5. Kulowski J: Pyogenic osteomyelitis of the spine. An analysis
and discussion of 102 cases. J Bone Joint Surg 64:
343–364, 1936
1265–1271, 1990
Percutaneous suction aspiration and drainage for pyogenic
8. Wisneski RJ: Infectious disease of the spine: Diagnostic and
treatment considerations. Orthop Clin North Am 22:
491–501, 1991
suction aspiration for osteomyelitis: report of two cases. Spine

Manuscript received August 24, 2005.
Accepted in final form February 7, 2006.

Address reprint requests to: Naoyoshi Hanaoka, M.D., Depart-
ment of Orthopedic Surgery, Oita Nakamura Hospital, 3-2-43, Ote-
machi, Oita 870-0022, Japan. email: ubucya@hotmail.com.