Management of Postoperative Spondylodiscitis with and without Internal Fixation

İnternal Fiksasyon ile veya Olmadan Postoperatif Spondilodiskit Tedavisi

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ABSTRACT

Postoperative spondylodiscitis is relatively uncommon. This complication is associated with increased cost, and long-term of inability to work, and even morbidity. Although the majority of postoperative spondylodiscitis cases can be well managed by conservative treatment, postoperative spondylodiscitis after internal fixation and those cases that are unresponsive to the conservative treatment present challenges to the surgeon. Here, a review was done to analyze the treatment of postoperative spondylodiscitis with/without internal fixation. This review article suggested that majority of postoperative spondylodiscitis without internal fixation could be cured by conservative treatment. Either posterior or anterior debridement can be used to treat postoperative spondylodiscitis without internal fixation when conservative treatment fails. In addition, minimally invasive debridement and drainage may also be an alternative treatment. In case of postoperative spondylodiscitis after internal fixation, surgical treatment was required. In the cervical spine, it can be well managed by anterior debridement, removal of internal fixation, and reconstruction of the spinal stability by using bone grafting/cage/anterior plate. Postoperative spondylodiscitis after internal fixation is successfully managed by combined anterior debridement, fusion with posterior approach and removal of pedicle screw or extension of pedicle screw beyond the lesion site, in the thoracic and lumbar spine.

KEYWORDS: Anterior debridement, Conservative treatment, Internal fixation, Posterior debridement, Spondylodiscitis, Surgery

INTRODUCTION

Postoperative spondylodiscitis is relatively uncommon. Most cases of postoperative spondylodiscitis are characterized by recurrent severe back pain and low fever after the initial spinal surgery (16, 32, 39). An elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) level is often demonstrated (20). Both of them are useful for early diagnosis of postoperative spondylodiscitis. Specially, CRP has been proved to be a sensitive indicator of the presence of postoperative spondylodiscitis (33). The X-ray and CT scan may indicate disc height loss and defect of the vertebral body at the late stage of spondylodiscitis (38). Therefore, X-ray and CT scan are rarely useful to detect the early infections. MRI has been shown to be the most useful study to diagnose postoperative spondylodiscitis, especially in the early stage of the infection (6, 47). The infected disc space appears as hypointense signals on T1- and hyperintense signals on T2-weighted MR images (42, 45). Based on the above clinical presentation, laboratory parameters, and radiological imaging, and the spinal operation history, the primary diagnosis of postoperative spondylodiscitis is not difficult for the spinal surgeon, at present. The objective of this article was to review the management of postoperative spondylodiscitis with/without internal fixation.

Conservative Treatment

Conservative treatment for postoperative spondylodiscitis without internal fixation

The conservative treatment of spondylodiscitis includes antibiotic therapy and immobilization such as bed rest and
spinal bracing. Once spondylodiscitis is diagnosed, patients are managed by empirical continuous intravenous broad-spectrum antibiotic and immobilization. Percutaneous biopsy of the affected vertebral bodies under CT monitoring was advised to determine the efficacy and safety of the antibiotics (13, 34). Antibiotics are adjusted to the sensitivities of these organisms according to the percutaneous biopsy results. In the series reported by Bettini et al., 56 patients with primary pyogenic spinal infection were successfully managed by antibiotic therapy and spinal bracing (5). In another series reported by Valancius et al., 91 cases of primary spondylodiscitis were managed conservatively. They concluded that conservative therapy is safe and effective for carefully selected patients without spondylodiscitic complications (44). Regarding the treatment of postoperative spondylodiscitis without internal fixation, Kutlay et al., (27) reported 22 cases treated with antibiotics and hyperbaric oxygen therapy. The results indicated that all 22 patients were successfully treated without recurrence. In the recent study of Basu, 17 cases of postoperative discitis were treated with rest and antibiotic therapy alone and 13 cases responded well to the conservative therapy (2). Postacchini and Cinotti reported 13 cases where postoperative spondylodiscitis was treated by antibiotics in 6 cases. Antibiotics were started at 31 days postoperatively on average and continued for 62 days, and symptoms were relieved after 3.9 months. At the final follow-up, X-ray indicated moderate changes of vertebral bodies in 4 cases and extensive osteolytic lesions of vertebral bodies in 2 cases. In the other 7 cases, antibiotics were initiated a mean of 8 days postoperatively and symptoms were relieved after 1.8 months without marked destructive lesions of the vertebral bodies. They concluded that the course of postoperative spondylodiscitis could be shortened by early and adequately prolonged antibiotic treatment. Extensive vertebral body lesions could also be avoided (37). Based on the above reports, antibiotics and bed rest are an effective treatment for the majority of the postoperative spondylodiscitis cases without internal fixation. Early and adequately effective antibiotic treatment can control spread of the infection and avoid the development of vertebral body lesions when early diagnosis is confirmed.

Conservative treatment for postoperative spondylodiscitis after internal fixation

Conservative treatment may not suitable for postoperative spondylodiscitis after internal fixation. There are several reports describing the management of postoperative spondylodiscitis after internal fixation. All the reports advocate radical debridement, removal of the internal fixation/extension of internal fixation beyond the lesion site, and fusion of the infected spinal segment for the treatment of postoperative spondylodiscitis after internal fixation.

Surgical Treatment

Surgical treatment for postoperative spondylodiscitis without internal fixation

For postoperative spondylodiscitis without internal fixation, operative management has been recommended when conservative treatment has failed (1, 20). Posterior debridement and fusion with or without instrumentation is widely used for spontaneous infectious spondylodiscitis (12, 17, 22, 48) since most spinal surgeons are familiar with the posterior operative approach. Several studies have reported that spontaneous infectious spondylodiscitis and septic hematogenous spondylodiscitis were successfully treated with posterior debridement and fusion with or without stabilization (12, 17, 22, 48) but there are only a few articles describing posterior debridement for the treatment of postoperative spondylodiscitis without internal fixation. In 2012, a retrospective study of 35 cases of postoperative spondylodiscitis without internal fixation was published where 29 patients who were unresponsive to conservative treatment were treated by posterior debridement and none of the cases required anterior fusion. Internal fixation was also not required. Within nine months follow-up, all patients recovered fully without disability or neurological deficit (20).

The infectious and necrotic tissues were mainly limited to the diseased intervertebral disc in the majority of the patients with pyogenic spondylodiscitis. Additionally, the posterior spinal structures were not greatly affected. Some of the recent reports indicated that anterior surgical approach could radically debride the infectious and necrotic tissue of the diseased intervertebral disc under direct visualization (9, 10). There are also reports of spondylodiscitis/pyogenic vertebral osteomyelitis being treated by anterior debridement and fusion with or without anterior instrumentation (8, 9, 11, 14). Additionally, anterior debridement combined with one-stage/staged posterior internal fixation has been used to treat patients with primary pyogenic vertebral osteomyelitis (10, 15, 36, 40, 43). There are few studies on anterior debridement for the treatment of postoperative spondylodiscitis, however. In the case reported by Ahn and Lee (1), 6 cases of postoperative spondylodiscitis after transformaminal percutaneous endoscopic lumbar discectomy, who were unresponsive to the extensive antibiotic therapy or surgical drainage, were treated by anterior lumbar interbody fusion with posterior instrumentation. The modified MacNab criteria results were good in 3 patients, fair in 2 patients and poor in one patient within 20 to 48 months of follow-up.

There are reports on surgical treatment other than open surgery for postoperative spondylodiscitis without internal fixation when conservative treatment has failed. In a retrospective case series analysis, Bavinzski et al., (4) reported 17 cases of septic postoperative spondylodiscitis without internal fixation treated by microsurgical debridement and application of a closed suction-irrigation system supported by specific antibiotic therapy. During the operation, all the patients were managed by the same microsurgical approach to remove the necrotic and infected tissue. The infected disc space was then extensively irrigated by normal saline, diluted povidone/iodine solution, and hydrogen peroxide. Finally, a closed vacuum suction-irrigation drainage system...
was inserted in the infected disc space. The rate of irrigation was maintained at 30-50 ml/h without antibiotics in the solution. Systemic intravenous antibiotics were used 3-4 weeks, followed by oral antibiotics for 2-3 months. All the patients became pain-free 2-4 weeks postoperatively and 14 of the 17 patients obtained good to excellent results. MRI examinations confirmed resolution of the infectious processes in 16 of the patients except one patient where MRI was not performed due to a metal implant. In the series of 34 patients of Li et al., (29), all the patients with postoperative spondylodiscitis without internal fixation were treated by percutaneous discectomy and drainage. Immediate relief of back pain was reported by 25 patients after this operative procedure. All cervical patients had pain improvement within 24h and the condition improved within the first week after the operative procedure. They monitored 31 cases from 2 to 10 years and they concluded this procedure was an invasive procedure for obtaining biopsy material for histological analysis and culture. In addition, this operative procedure had a good clinical outcome.

Although the use of anterior or posterior debridement for the treatment of spondylodiscitis remains controversial, patients with postoperative spondylodiscitis who were unresponsive to conservative treatment can be successfully managed either with posterior or anterior debridement based on the literature. Moreover, minimally invasive debridement and drainage may be also an alternative treatment for postoperative spondylodiscitis when conservative management has failed, especially in elderly patients and patients in poor condition.

**Surgical treatment for postoperative spondylodiscitis after internal fixation**

For the treatment of postoperative spondylodiscitis after internal fixation, the few published reports unanimously agree that operative procedures are required. In the cervical spine, three reports have described the management of postoperative spondylodiscitis after internal fixation (Table I). In 2006, Kulkarni and Hee (26) described a 56-year-old male patient who presented with C4/5 spondylodiscitis occurring adjacent to C5/6 and C6/7 levels for which anterior cervical discectomy and fusion using PEEK cages and plating was performed. This patient underwent debridement,

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**Table I: Data of the Management of Postoperative Spondylodiscitis After Internal Fixation in the Cervical Spine**

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Operative approach</th>
<th>Initial internal fixation</th>
<th>Cervical spine reconstruction</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kulkami and Hee (26)</td>
<td>Case report</td>
<td>Anterior debridement</td>
<td>Anterior plate removed, cage left in place</td>
<td>Autograft</td>
<td>Fusion</td>
</tr>
<tr>
<td>Basu and Sreeramalingam (3)</td>
<td>Case report</td>
<td>Anterior debridement</td>
<td>Removed</td>
<td>Autograft and anterior plate</td>
<td>Fusion</td>
</tr>
<tr>
<td>Korovessis et al. (25)</td>
<td>Case report</td>
<td>Anterior debridement</td>
<td>Cage removed, posterior instrumentation left in place</td>
<td>Cage with autograft</td>
<td>Fusion</td>
</tr>
</tbody>
</table>

**Table II: Data of the Management of Postoperative Spondylodiscitis After Internal Fixation in the Thoracic and Lumbar Spine**

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Operative approach</th>
<th>Initial internal fixation</th>
<th>Thoracic and lumbar spine reconstruction</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carmouche and Molinari (7)</td>
<td>Case report</td>
<td>Not clear</td>
<td>Removed</td>
<td>Posterolateral autograft</td>
<td>Fusion</td>
</tr>
<tr>
<td>Neumayer et al. (35)</td>
<td>Case report</td>
<td>Posterior and second-stage anterior debridement</td>
<td>Removed</td>
<td>Anterior autograft and instrumentation</td>
<td>Fusion</td>
</tr>
<tr>
<td>Lange et al. (28)</td>
<td>Case report</td>
<td>Repeat anterior debridement and posterior instrumentation extension</td>
<td>Left in place</td>
<td>Cage with autograft and posterior instrumentation</td>
<td>Fusion</td>
</tr>
<tr>
<td>Hsieh et al. (23)</td>
<td>Case series</td>
<td>Posterior and first-/second-stage anterior debridement</td>
<td>9 Removed 2 Left in place</td>
<td>Anterior autograft Posterior instrumentation for 2</td>
<td>Fusion</td>
</tr>
</tbody>
</table>
After surgical intervention with posterior stabilization, an old woman suffering from L1/2 spondylodiscitis initially was noted (35). In 2010, Lange et al. (28) reported a 70-year-old male patient. Anterior debridement and removal of internal fixation were performed. Afterward, C3/4 was fused by using iliac crest bone grafting and anterior plate. At the final follow-up, he had completely recovered and gone back to work. Additionally, X-rays confirmed good fusion from C2 to C7 without signs of recurrence of infection. In 2012, Korovessis et al. (25) reported a case of cervical spondylodiscitis associated with oesophageal perforation after combined staged posterior (lateral mass screws) and anterior (plate, PEEK) fusion for C5/6 fracture dislocation. This patient also underwent debridement, removal of the anterior spinal implants, and a mesh cage with iliac bone graft was inserted into the C5/6 disc space. The esophagus posterior wall was fixed with sutures. Successful fusion was obtained between C5/6 without infection recurrence at the final follow-up. Based on the review of above articles, postoperative spondylodiscitis after anterior fusion for C5/6 fracture dislocation can be well managed by radical anterior debridement, removal of internal fixation at the lesion site, and reconstruction of cervical spinal stability by using bone grafting with/without cage and/or anterior plate.

In the thoracic and lumbar spine, several studies had described the management of postoperative spondylodiscitis after internal fixation (Table II). The first report in postoperative spondylodiscitis after internal fixation was published by Carmouche and Molinari (7), they reported a 35-year-old male patient with a diagnosis of epidural abscess and discitis at the T4/5 level after instrumented posterior lumbar interbody fusion using a single carbon fiber interbody cage. Surgical debridement and epidural abscess drainage were performed. However, his clinical symptoms, ESR and CRP levels were not improved and became even worse. Repeat debridement was performed, and his interbody cage and pedicle screw instrumentation were removed. Six months postoperatively, X-ray demonstrated solid bilateral posterolateral arthrodesis of L4/5 and the clinical symptoms were reduced at the final follow-up. Although the details pertaining to the operative approach in this case is lacking, it is apparently important to remove the internal fixation at the infection site. In 2009, Neumayer, F reported a case of T12/L1 postoperative spondylodiscitis after internal fixation due to a multi-resistant organism. The infection was controlled by anterior debridement, anterior internal fixation, and 12 months of intravenous antibiotic treatment. At the final follow-up, spinal fusion was achieved. Moreover, reoccurrence of infection was not noted (35). In 2010, Lange et al. (28) reported a 70-year-old woman suffering from L1/2 spondylodiscitis initially. After surgical intervention with posterior stabilization, debridement, and replacement of the L1/2 vertebral bodies, adjacent spondylodiscitis at T10/11 was diagnosed 2 months postoperatively. Removal of the vertebral body of T11 and extension of posterior instrumentation were carried out. However, repeated spinal radiographs and MRI indicated an adjacent spondylodiscitis at the T8/9 level 14 months later. Removal of the vertebral bodies of T8 and T9 was carried out and the posterior stabilization was extended up to T5. At the last follow-up, clinical examination, blood testing, and radiograph suggested no evidence of any further spondylodiscitis.

The first series describing postoperative spondylodiscitis after internal fixation was reported by Hsieh et al. (23) in 2011. He reported 11 patients diagnosed with postoperative spondylodiscitis after posterior pedicle screw instrumentation for 10 cases of degenerative lumbar disease and a case of osteoporotic spine fracture. For the treatment of spondylodiscitis, internal fixation was removed in 9 patients who had concomitant posterior infection. The posterior pedicle screw was extended beyond the lesion site in the other 2 patients without posterior infection who had confirmed pseudarthrosis. In these 11 patients, 6 cases were treated by posterior debridement and removal of instrumentation, and one-stage anterior debridement and fusion. Staged anterior debridement and fusion were performed for the other 5 cases after the first staged posterior surgery. At the final follow-up, the 11 patients were all successfully treated by removal of instrumentation/extension of instrumentation beyond the lesion site, and one-stage/staged anterior debridement and fusion. As it is well known, anterior debridement can radically remove infectious and necrotic tissue in the disc space under direct visualization. Extension of the pedicle screw can provide immediate spinal stability, which is helpful in the healing process of the infection. Taken together, postoperative spondylodiscitis after internal fixation can be successfully managed by combined anterior debridement and fusion with a posterior approach removal of pedicle screw if spinal fusion is obtained, or extension of the pedicle screw beyond the lesion site if spinal fusion is not obtained, in the thoracic and lumbar spine.

**Prevention**

Due to the increase in spinal surgery, postoperative spondylodiscitis has been recently reported as an increasing complication of such surgery (19, 21, 24, 30, 46). Careful intraoperative technique, irrigation of the incision, and perioperative/intraoperative antibiotics are recommended for the prophylaxis of postoperative spondylodiscitis. To prevent postoperative spondylodiscitis, appropriate use of antibiotics is the most important prophylaxis. Some reports argue that perioperative antibiotics can effectively prevent postoperative spondylodiscitis (18, 49). Others believe that intraoperative antibiotic prophylaxis is effective to prevent postoperative spondylodiscitis after spinal surgery. Additionally, postoperative prophylaxis is not adopted or significantly reduced (30, 31). A retrospective study reported that placement of gentamicin-containing collagenous
sponges in the disc space were effective in preventing postoperative spondylodiscitis (41).

In summary, preoperative/intraoperative antibiotics can effectively prevent the postoperative spondylodiscitis after spinal surgery because it is considered that prophylactic antibiotics can eliminate bacteria that are iatrogenically inoculated into the disc space during the operation. The local use of antibiotics is effective in preventing postoperative spondylodiscitis as well, although there are few reports.

CONCLUSION

Once the primary diagnosis is confirmed, early and adequately prolonged antibiotic treatment is recommended. The majority of the postoperative spondylodiscitis without internal fixation cases can be successfully treated by conservative treatment. Either posterior or anterior debridement can be used to treat postoperative spondylodiscitis without internal fixation when it is unresponsive to conservative treatment. Minimally invasive debridement and drainage may also be an alternative treatment. Surgical treatment was required for postoperative spondylodiscitis after internal fixation. In the cervical spine, it can be well managed by anterior debridement, removal of internal fixation, and reconstruction of the spinal stability by using bone grafting/cage/anterior plate. In the thoracic and lumbar spine, it can be successfully managed by combined anterior debridement and fusion with posterior approach removal of pedicle screw or extension of pedicle screw beyond the lesion site. In conclusion, the morbidity and the serious complications of postoperative spondylodiscitis can be decreased with early diagnosis and proper treatment.

ACKNOWLEDGMENTS

This work is supported by the National Natural Science Foundation of China (81101380) in the manuscript.

REFERENCES