ORIGINAL

Full-endoscopic interspinous cleaning surgery for chronic low back pain associated with Baastrup's disease : a technical note and case series

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Abstract : Chronic low back pain due to impingement of two adjacent spinous processes has been called Baastrup's disease. The diagnosis can be confirmed by interspinous infiltration of local anesthetic. However, little evidence regarding its pathology and treatment exists. Considering previous reports and our cases, three pathologies including impingement caused by contact between two adjacent spinous processes, inflammation and synovitis at the interspinous ligament, and inflammation and synovitis in the tissue surrounding the interspinous area are needed to be addressed. Conservative treatment with an interspinous steroid injection has been reported, as has surgery consisting of partial resection of the spinous processes or installation of an interspinous spacer. Thus, surgical strategy should include partial resection of the spinous processes causing impingement, removal of the interspinous inflammatory bursitis, and radiofrequency ablation of the surrounding tissue. Another surgical option that can achieve these strategies is a minimally invasive full-endoscopic procedure, which we refer to as "full-endoscopic interspinous cleaning surgery." Briefly, the bony surface on the spinous processes is removed by the drill and the surrounding tissues are ablated using a bipolar radiofrequency device. This report describes the surgical technical presentation and the clinical outcomes for 3 cases based on the pathologies.
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INTRODUCTION

The pain generator for chronic low back pain caused by impingement of two adjacent spinous processes was first described by Baastrup in 1933 (1). Since then, this entity has been called Baastrup's disease (BD). The basic pathology is interspinous synovitis (2-4) resulting from the impingement. Also known as kissing spine syndrome (5, 6), BD is relatively common in the older population, and has been considered to be an aging-related degenerative condition (1-6). However, Ali *et al*. (7) and Yamada *et al*. (3) have encountered BD in younger patients and concluded that trauma could be another pathogenetic mechanism.

The literature contains reports of both conservative (8, 9) and surgical (10-13) treatments for BD. An interspinous block can be effective (8, 9, 14), but a few reports demonstrated surgical outcomes in patients refractory to conservative treatment. In theory, the pain is caused with extension of the lumbar spine, so fusion (3) or stabilization (12) should be effective. However, the pathology is synovitis and spinous processes rubbing against each other, which would be best treated in a minimally invasive manner. In this paper, we review the pathologies and management of BD and describe the technical presentation of novel full-endoscopic procedure with two representative cases that can treat these pathologies and clinical outcomes of three cases.

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MATERIALS AND METHODS

Ethics statement

The study protocol was approved by the institutional review board of our institution (approval no. 3642). Written consent for patient information and images to be published was obtained from all the participants. The present study was conducted in accordance with the principles of the Declaration of Helsinki and the laws and regulations of Japan.

Patients and Diagnosis

We retrospectively reviewed three patients with chronic low back pain due to BD who underwent surgery at our institution between January and June 2024. Demographics and low back pain duration was retracted from electrical medical records. The main clinical symptom of BD is low back pain, especially during extension of the lumbar spine. Radiologically, we refer to the findings on short tau inversion recovery (STIR)-magnetic resonance imaging (MRI). BD is strongly suspected if the sagittal image shows high signal intensity at the interspinous space, indicating edema or inflammation of the interspinous ligament. A diagnosis of BD is confirmed by the findings of tenderness over the affected spinous processes in conjunction with high signal intensity on a STIR-MRI scan. If the visual analog scale (VAS) score for low back pain decreases by more than 50% immediately after the injection of local anesthetic (2–5 mL of 1% or 2% lidocaine) into the interspinous space, BD is diagnosed as the main pain generator. All patients with BD were resistant to conservative treatments for more than 6 months including physical therapy, medications, and at least 2 or more interspinous injections with corticosteroids. As a primary outcome, the VAS score for low back pain was recorded preoperatively and one day postoperatively. The

VAS score was also recorded two weeks, three months, and six months postoperatively. Data are presented as mean ± standard deviation. All patients were routinely followed up at 1, 3, 6, and 12 months postoperatively.

Pathologies to be resolved

1) Impingement of two adjacent spinous processes (kissing spines)
2) Inflammation and synovitis at the interspinous ligament
3) Inflammation and synovitis surrounding the interspinous area

Surgical technique

The entire procedure is performed under full-endoscopic guidance. To explain the technique, we give the example of the procedure when performed at the level of L4/5. An 8-mm skin incision is made over the cranial aspect of the L5 spinous process. An 8-mm cannula is then docked under the L4 spinous process (Figure 1A). An endoscopic view at the start of the surgery is shown in Figure 1D. About 20%–40% of the caudal aspect of the L4 spinous process is removed using a high-speed drill to prevent the impingement of two adjacent spinous processes, which is confirmed under fluoroscopy. The base of the spinous process and part of the lamina is also removed (Figures 1B and 1E). Next, the interspinous ligamentous and scar tissues are removed. The cannula is then turned around and the L5 spinous process is viewed endoscopically. The bony surface on the cranial aspect of L5 is removed by the drill, creating a large cavity between the two spinous processes. Finally, the tissues surrounding the cavity are ablated using a bipolar radiofrequency device (Figure 1C). The aforementioned three pathologies can be resolved using this procedure.

RESULTS

Immediately after the full-endoscopic surgery, chronic low back pain greatly improved and maintained in all patients. The VAS score for low back pain decreased from 5.3 ± 0.5 to 0.7 ± 0.9 on the first postoperative day. The mean age was 46.3 ± 21.0 years. The duration of low back pain was 7.5 ± 8.8 years. Of the three patients, two were men and one were woman. Demographics, clinical characteristics, and outcomes are shown in Table 1.

In this paper, we described two cases who were followed up at least 6 months. In both of the cases, inflammation at the interspinous space could be seen on STIR-MRI scans. Although contact between two adjacent spinous processes was not detected, the interspinous space was narrow in comparison with the other levels. Both patients complained of low back pain in extension and of tenderness over the affected spinous processes. There were no neurological symptoms, such as muscle weakness, hypoesthesia, or leg pain in either case. The pain was alleviated by

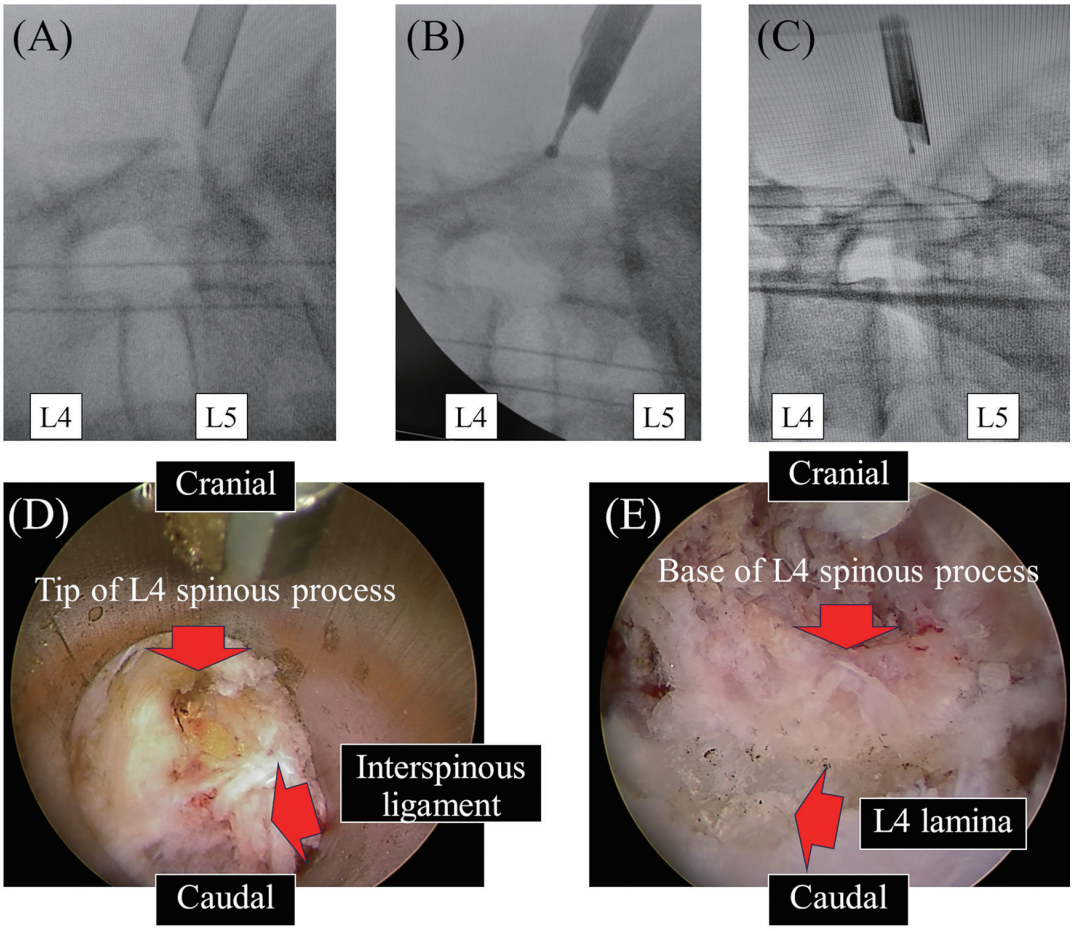

Figure 1. C-arm view (A–C) and endoscopic images (D, E) during surgery. (A) An-8 mm cannula is docked under the L4 spinous process. (B) The spinous process of L4 is drilled. (C) The tissues surrounding the cavity that has been created is ablated using a bipolar radiofrequency device. (D) is the endoscopic view at the start of the surgery and (E) shows the base of the spinous process and part of the lamina.

interspinous infiltration of 1%–2% lidocaine. Two spinal levels were involved in both patients. The VAS score for pain decreased from 5 to 0 after full-endoscopic interspinous cleaning surgery and maintained for at least 6 months in both cases.

Case 1

The patient was a 50-year-old woman who presented with a 1-year history of low back pain. STIR-MRI scans showed high signal intensity in the interspinous areas at L3/4, L4/5, and L5/S1 (Figure 2A). Tenderness was observed at L4/5 and L5/S1. Her pain resolved completely after interspinous injection of local anesthetic at L4/5 and L5/S1 (Figure 2B). Full-endoscopic interspinous cleaning was performed at L4/5 and L5/S1 via two 8-mm skin incisions (Figure 3A) under general anesthesia. The operative time was 68 min and the blood loss was a negligible amount. No complications were observed. On the day after full-endoscopic interspinous cleaning surgery, her VAS score for pain had decreased from 5 to 0. A sagittal computed tomography scan confirmed successful partial resection of the adjacent spinous processes at L4/5 and L5/S1 (Figure 3B, 3C). On follow-up 12 months later, she remained free of low back pain.

Table 1. Demographics, clinical characteristics, and outcomes of three patients.

Age	Sex	Interspinous high signal	Spinous process bone bruise	Level	LBP duration	VAS before surgery	VAS at 1 day	VAS at 1 year
50	F	+	–	L4/5/S1	1 Y	5	0	0
19	M	+	–	L4/5/S1	1.5 Y	5	0	0
70	M	+	+	L4/5	20 Y	6	2	2

F, female ; L, low back pain ; M, male ; VAS, visual analog scale

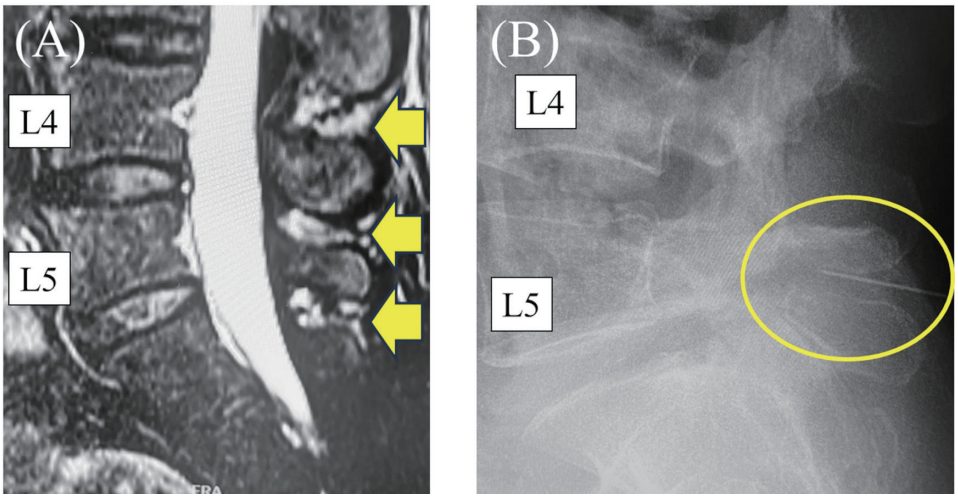

Figure 2. Images for case 1. (A) STIR-MRI scan showing high signal intensity in the interspinous areas at L3/4, L4/5 and L5/S1. (B) A radiograph showing the interspinous injection at L4/5. STIR-MRI, short tau inversion recovery-magnetic resonance imaging

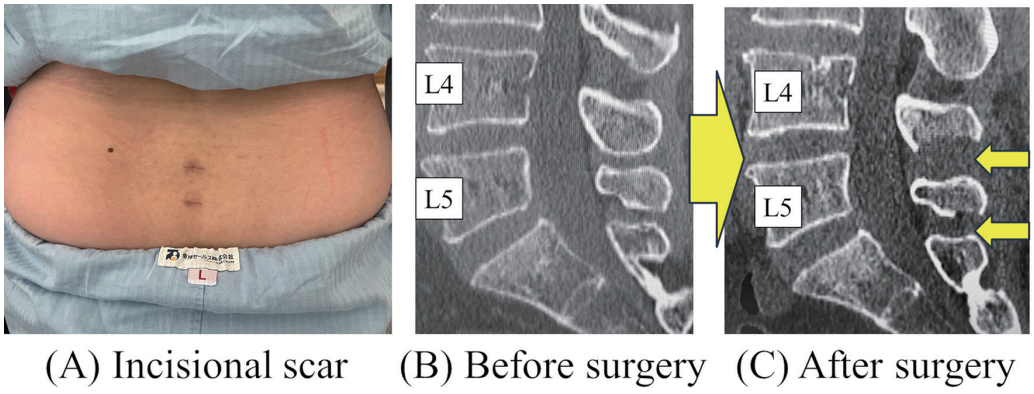

Figure 3. Photograph and CT scans for case 1. Full-endoscopic interspinous cleaning was performed at L4/5 and L5/S1 via two 8-mm skin incisions under general anesthesia. (A) Clinical photograph showing the incisional scars after surgery. (B) Sagittal CT scan obtained before surgery. (C) Sagittal CT scan obtained after surgery showing successful partial resection of the adjacent spinous processes at L4/5 and L5/S1. CT, computed tomography

Case 2

The case was a 20-year-old male college-level football player with a history of low back pain. About 1.5 years earlier, during his third year of high school, he had sustained a fall that caused a compression fracture in the vertebral body at L3. He had experienced severe pain, which resolved after wearing a brace for 3 months. Although the fracture in the vertebral body had healed, he noticed lumbar extension pain during sports activity and could not participate in soccer practice. He then started college, where he could not undertake any sports activities because of pain on extension. Conservative treatment failed, and interspinous injection of 1% lidocaine only partially alleviated the pain. Therefore, the referring physicians suggested that BD could be the pain generator.

A CT scan obtained before surgery showed an abnormally shaped L5 spinous process that was facing upward (Figure 4A) and appeared to be in contact with the L4 spinous process on extension. A STIR-MRI scan showed prominent hyperintensity at the L4/5 interspinous ligament (Figure 4B). Additionally, high signal intensity was also seen at the interspinous space at the L5/S1 level on STIR-MRI (Figure 4B). We injected 2% lidocaine at L4/5 and L5/S1, after which the pain on extension resolved completely. The patient had not been able to play soccer for 1.5 years because of his chronic low back pain and opted for surgical intervention. Although we diagnosed the main pain generator as BD at the L4/5 level, the patient hoped to include the L5/S1 level at the surgery, because the patient had a long period of soccer suspension and hoped a more reliable pain relief and return to sports. Full-endoscopic interspinous cleaning was performed at L4/5 and L5/S1 under general anesthesia. The operative time was 101 min and the blood loss was a negligible amount. No complications were observed. His pain disappeared completely, with a decrease in his VAS score from 5 to 0 on the first postoperative day. A sagittal CT scan showed successful resection of part of the adjacent spinous processes at L4/5 and L5/S1 (Figure 5A, 5B). Figure 5C shows his ball shooting performance 1 week later. Before surgery, when he put his right leg backwards, his trunk

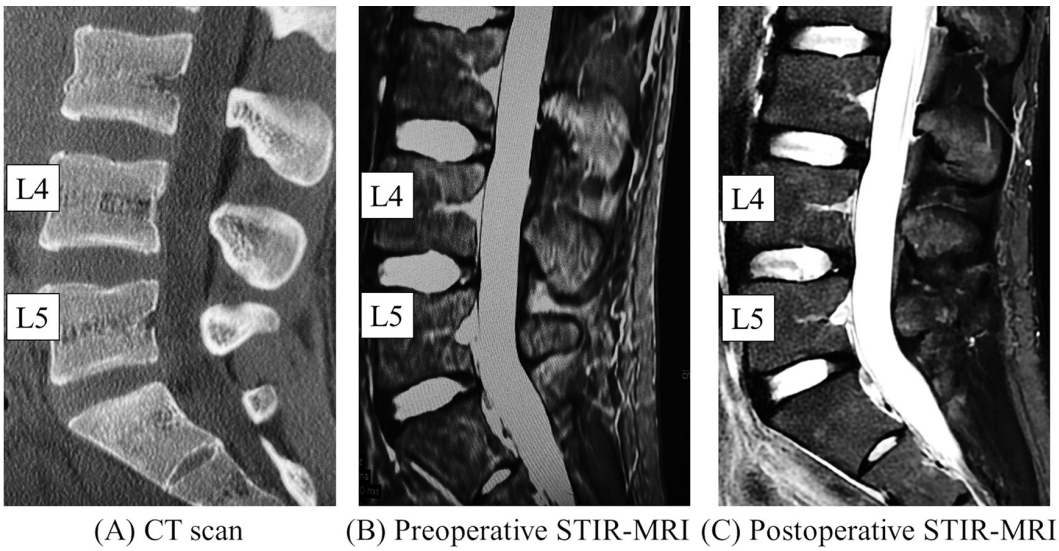

Figure 4. CT and STIR-MRI scans obtained for case 2 before surgery. (A) A preoperative CT scan showing an abnormally shaped L5 spinous process that is facing upwards. (B) Preoperative STIR-MRI scan showing hyperintensity at the interspinous ligament at L4/5 and L5/S1. (C) A STIR-MRI scan 1 year after surgery showing a decrease in interspinous intensity at L4/5 and L5/S1. CT, computed tomography ; STIR-MRI, short tau inversion recovery-magnetic resonance imaging

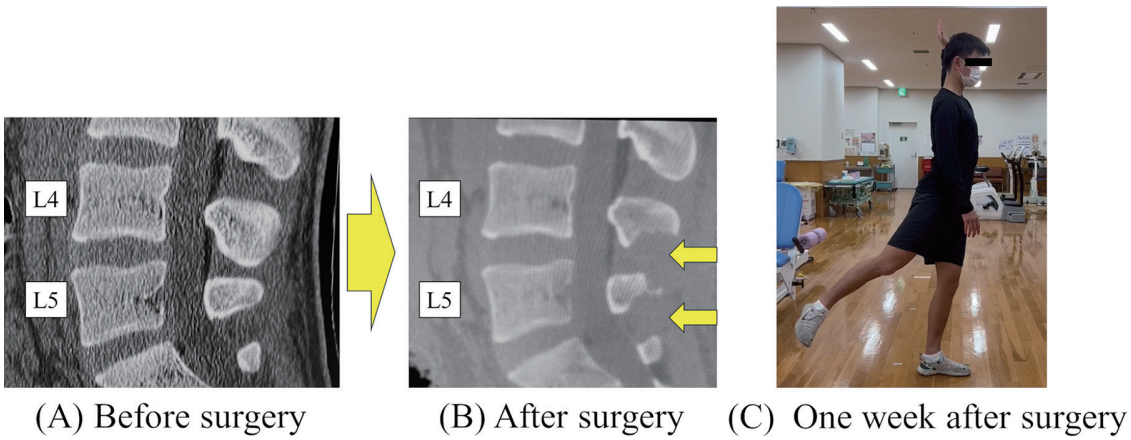

Figure 5. Computed tomography scans and clinical photograph obtained for case 2, who underwent partial resection of the adjacent spinous processes successfully at L4/5 and L5/S1. (A) Before surgery. (B) After surgery. (C) A photograph taken 1 week after surgery showing the patient's shooting posture with trunk extension and no low back pain.

bent forward because he could not extend his spine. After the surgery, he was able to extend his spine and returned to soccer practice 3 months later without low back pain. He returned to play 6 months postoperatively and she remained free of low back pain 12 months postoperatively. A sagittal image on STIR-MRI 1 year after surgery showed a significant decrease in interspinous intensity at L4/5 and L5/S1.

DISCUSSION

This report discusses the diagnosis of BD and its surgical treatment. We have identified the following three pathologies as the pain generator in BD : kissing spine, inflammation and synovitis at the interspinous ligament, and inflammation and synovitis in the surrounding interspinous area. These pathologies can be resolved using our minimally invasive full-endoscopic procedure. We have now treated three cases of BD using full-endoscopic interspinous cleaning surgery, and the short-term results have been excellent.

Pathogenesis of BD

Singla *et al*. (5) reported a case of a 67-year-old man with BD in whom the lesion was a kissing spine. It was possible to appreciate the contact between two spinous processes, bony sclerosis, and cyst formation on a lateral plain radiograph. However, inflammation and edema are difficult to detect on a plain radiograph, but may be seen on STIR-MRI. Sağtaş *et al*. (15) revealed bone marrow edema of the spinous processes on STIR-MRI in a patient with kissing spine syndrome.

In 1954, Yamada *et al*. (3) published a case report on a 29-year-old man with BD whom they treated with surgery. The spinous processes were removed from L3 to L5, after which posterior spinal fusion was performed. Histology revealed chronic inflammation and synovitis in the interspinous ligaments at L3/4 and L4/5. These pathological findings are in agreement with findings on STIR-MRI (15).

Given the increased incidence with age (2, 15), BD has long been assumed to be caused by aging-related degeneration of the spine. However, another possible cause is trauma. The 29-year-old man in the report by Yamada *et al*. (3) had fallen on the floor with his lumbar spine in a hyperextended position and subsequently developed severe chronic low back pain. They concluded that trauma was the cause of the BD. This pathology is in good agreement with that in the second patient described in this report. Ali *et al*. (7) similarly identified BD among pediatric gymnasts, while Mann *et al*. (16) reviewed causes of low back pain in college athletes and identified BD as a potential pain generator, especially among gymnasts. These reports support the theory that trauma is another underlying cause of BD.

In our case series, 2 patients develop low back pain with no direct bony contact between the spinous processes on a plain radiograph at extension. Okada *et al*. (8) also demonstrated that 6 (35.3%) of 17 patients with BD had no direct contact between the spinous processes at extension. Therefore, impingement of two adjacent spinous processes (kissing spines) is not a requirement for BD diagnosis. Some patients can develop low back pain due to inflammation and synovitis at the interspinous ligament and surrounding the interspinous area without direct contact at extension.

Treatment of BD

BD can be treated conservatively by interspinous block. Kerroum *et al*. (17) described this treatment step by step. Their patient's low back pain was treated successfully by interspinous block after intensive conservative treatment. In a study by Okada *et al*. (8) that included 17 patients with BD, injection of lidocaine and dexamethasone into the interspinous ligament was effective for reduction of low back pain. At the final follow-up 1.4 years after the injections, no patient required surgery and low back pain scores significantly improved as compared with before the treatment.

Partial resection of a spinous process is another common treatment. Corr *et al*. (10) performed partial resection of a spinous process in a 46-year-old man with BD. Following the surgery, the patient's pain resolved almost completely. They also reviewed the literature (11, 13, 17-19) and found that the outcomes after surgery for BD were mixed. Two papers published before 2000 reported cases that had a poor outcome (13, 18). However, the reports published since 2000 (10, 11, 17, 19) have indicated good outcomes, as in our two cases. This is not surprising considering the increasing availability of diagnostic tools such as MRI, which can detect inflammation. With a precise diagnosis and use of an interspinous block, successful surgery for BD is now possible.

Partial removal of a spinous process is already possible during full-endoscopic spine surgery (FESS) (11). FESS can be performed under local anesthesia, requires only an 8-mm skin incision, and causes minimal damage to the back muscles. Therefore, FESS is by far the least invasive spine surgery, including for patients with BD. The two cases described here required treatment at two levels, and the surgery was performed under general anesthesia. However, another case with BD involving one level underwent this surgery under local anesthesia without perioperative problems.

FESS was initially used for lumbar discectomy in patients with herniated nucleus pulposus in around 2000 (20). However, with the advent of tools such as the high-speed surgical drill, decompression of spinal stenosis became possible (21). Recently, a more minimally invasive FESS technique was developed for spinal fusion with reduction (22). Finally, it became possible to treat BD using FESS (11), and we anticipate that the indications for this surgery will expand further in the future.

Nomenclature

We have proposed "interspinous cleaning" as the nomenclature for surgical decompression or removal of a spinous process. Historically, Corr *et al*. (10) referred to "partial spinous process resection," while Yue *et al*. (19) and Kerroum *et al*. (17) referred to "spinous process excision" and "excision of a spinous process." More recently, Lin *et al*. (11) performed partial removal/excision of a spinous process and referred to their technique as "interspinous plasty."

As mentioned earlier, three pathologies need to be addressed in BD, including impingement caused by contact between two adjacent spinous processes, inflammation and synovitis at the interspinous ligament, and inflammation and synovitis in the tissue surrounding the interspinous area. The previous surgical techniques focused only on the bony pathology, without addressing the soft tissue pathology. We have proposed the name "interspinous cleaning surgery" to describe our procedure, which addresses all three pathologies seen in BD.

Limitations

We have several limitations. First, this case series lacks a control group. Second, we have no experience with open surgery for BD. Therefore, we were not able to compare outcomes with the control or open surgery. Third, the number of patients was small. Further study with larger sample size is warranted to lead to a more plausible evidence, although the number of patients with BD refractory to conservative management is not many. Additionally, the long-term follow-up is desired to evaluate recurrence

or delayed instability at the segment.

In summary, we have diagnosed Baastrup's disease based on radiological findings. The diagnosis was confirmed by interspinous infiltration of local anesthetic. FESS was used to address the bony and soft tissue pathologies. We have named this procedure full-endoscopic interspinous cleaning. It requires only an 8-mm skin incision. Full-endoscopic interspinous cleaning is a minimally invasive surgical treatment for Baastrup's disease, and may become the gold standard surgery for this condition in the future.

CONFLICT OF INTEREST DISCLOSURE

The authors declare no financial supports and no conflict of interest.

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