Fusion After Interspinous Device Placement

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abstract

Lumbar interspinous devices are intended to unload the facet joints, restore foraminal height, lower intradisk pressure, and provide motion-preserving stabilization. They are an alternative treatment for patients with spinal degeneration and have increased in popularity in recent years. To the authors’ knowledge, heterotopic ossification has not been previously reported around an interspinous device, and this is the first reported case of interspinous fusion after interspinous device placement.

A 66-year-old man presented with a 3-year history of low back pain and a 4-month history of radiating pain down his left leg. A diagnosis was made of lumbar spinal stenosis and left disk herniation at L4-L5 after physical and imaging examinations. A dynamic interspinous device was implanted after the decompressive surgery. The patient's symptoms were relieved postoperatively. Thirty-two months later, he returned with back pain after being in a traffic accident. Lumbar radiographs showed a massive bony formation around the implant. Radiographs and a computed tomography scan 4.5 years later revealed that the implanted device segments were fused. No implant motion was seen on dynamic radiographs. Because the patient was symptom free, no interventions were performed.

Heterotopic bone formation around a dynamic interspinous device may hamper motion preservation, and heterotopic ossification is a potential mid- and long-term complication.

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Figure 1: Anteroposterior radiograph of the lumbar spine showing massive bony formation around the device 4.5 years postoperatively.

Figure 2: Two-dimensional coronal computed tomography reconstruction confirming heterotopic bone formation around the interspinous device 4.5 years postoperatively.
Spinal fusion has been the standard surgical procedure for various spinal diseases for the past century. One disadvantage of this technique is adjacent segment degeneration due to the increased load transferred from the fused level. As a nonfusion technique, the interspinous device provides motion-preserving stabilization. The device unloads the facet joints, restores foraminal height, lowers intradisk pressure, and restricts overextension. It is an alternative treatment for patients with spinal degeneration. This device has increased in popularity in recent years. Although promising, the device is still in the early stage of clinical use. To the authors’ knowledge, interspinous fusion due to heterotopic ossification after placement of an interspinous device has not been previously reported.

**Case Report**

A 66-year-old man presented with a 3-year history of low back pain. He also reported numbness and bilateral leg pain with prolonged standing or walking. Four months before presentation, his low back pain worsened and began radiating down his left leg. The leg pain was relieved with sitting. On examination, he had some lumbar tenderness and a palpable muscle spasm. Straight-leg raise testing was positive on the left side and negative on the right side. Strength and sensation were normal in both legs. Bilateral ankle and knee jerks were normal. No pathological reflex was observed. Magnetic resonance imaging of the lumbar spine obtained in another hospital revealed canal stenosis and left disk herniation at L4-L5.

After giving informed consent, the patient underwent decompressive surgery and additional implantation of an interspinous device at the authors’ institution. He was placed in a prone position under general anesthesia. Subperiosteal dissection of the paraspinal muscles was performed through a midline approach. Decompressive surgery was conducted through a hemilaminotomy, resection of the thickened ligamentum flavum, and removal of the herniated disk. A properly sized interspinous implant (Coflex; Paradigm Spine, New York, New York) was inserted into the interspinous space after excision of the interspinous ligament. The clips around the spinous processes were tightened.

The patient’s leg pain resolved postoperatively. Postoperative lumbar radiographs confirmed the accuracy and firmness of the internal fixation (Figure 1). The rehabilitation course was uneventful. He was satisfied with the surgical treatment. Six months postoperatively, dynamic radiographs revealed motion at the implanted level. No loosening of the fixation or bony formation around the device was observed. The patient declined further follow-up.

Thirty-two months later, he returned with back pain after being in a low-speed traffic accident. Lumbar radiographs showed no signs of fracture of the spinous processes or the devices. However, a massive bony formation was found around the implant. Four and a half years later, radiographs of the spine revealed bony fusion of the fourth and fifth spinous processes (Figure 2). The peridevice space was filled with heterotopic ossification, which was confirmed by computed tomography reconstructions (Figures 3, 4). No implant motion was seen on dynamic radiographs. Because the patient was symptom free, no interventions were performed.

**Discussion**

Several interspinous implants are currently available on the market. One aim of the devices is to maintain a moderate degree of distraction between the spinous processes. They are classified as dynamic or static interspinous spacers. Static spacers, such as the X-Stop (St Francis Medical Technologies, Concord, California) and Wallis (Abbott Spine, Bordeaux, France) implants, are noncompressible devices. Dynamic spacers, such as DIAM (Medtronic Sofamor Danek, Memphis, Tennessee) and Coflex implants, are compressible devices. Because the interspinous spacers are nonrigid stabilization systems, a certain degree of motion of the pathological level is preserved. Thus, the stress of the adjacent intervertebral disk could be lowered, which might delay the oc-

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**Figure 1:** Anteroposterior radiograph of the lumbar spine showing a well-positioned interspinous device 1 week postoperatively.

**Figure 2:** Anteroposterior radiograph of the lumbar spine showing massive bony formation around the device 4.5 years postoperatively.
Heterotopic ossification is also common after total hip and knee arthroplasty. In the field of spinal surgery, it is seen in patients with musculoskeletal trauma, spinal cord injury, and central nervous system injury. Heterotopic ossification is also common after total hip and knee arthroplasty. The reported rates of heterotopic ossification ranged from 2% to 90% after total hip arthroplasty and 1% to 42% after total knee arthroplasty. In the spinal field, heterotopic ossification has been closely studied because of its reported high prevalence after total disk replacement. In a meta-analysis by Chen et al., the pooled prevalence of heterotopic ossification was 44.6% twelve months after total cervical disk arthroplasty and 58.2% twenty-four months postoperatively. The clinical significance of heterotopic ossification around interspinous devices is similar to that around artificial disks. McAfee et al. described and classified heterotopic ossification for lumbar total disk replacement. According to this classification, the current patient was classified as class IV: heterotopic ossification that formed around the implant with no motion shown on dynamic radiographs.

Figure 3: Two-dimensional sagittal computed tomography scan reconstruction revealing heterotopic bone formation in the interspinous space.

Figure 4: Two-dimensional coronal computed tomography reconstruction confirming heterotopic bone formation around the interspinous device 4.5 years postoperatively.

The reported rates of heterotopic ossification formation in the interspinous space. The occurrence of degeneration of the adjacent levels. General complications, such as infections, spine fracture, device failure or malposition, and neurologic complications, have been reported in recent studies. Rare complications, including stress fracture of the posterior facet, erosion of the spinous process, and the sandwich phenomenon in double-level surgery, have also been reported.

In the current case, spontaneous fusion occurred because of heterotopic ossification formation in the interspinous space after the placement of an interspinous device, which, to the authors’ knowledge, has not been previously reported. Although no obvious clinical symptoms were observed in the current patient, heterotopic ossification could be a potential complication in the mid and long term because it may hamper the motion preservation.

Heterotopic ossification is classified as hereditary or acquired. The former, known as myositis ossificans progressive, is rare. The latter, which is more common, is seen in patients with musculoskeletal trauma, spinal cord injury, and central nervous system injury. Heterotopic ossification is also common after total hip and knee arthroplasty.

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Risks for developing heterotopic ossification after total hip and knee arthroplasty include hypertrophic osteoarthritis, previous history of heterotopic ossification, ankylosing spondylitis, diffuse idiopathic skeletal hyperostosis, Paget’s disease, and increased lumbar bone mineral density. Factors affecting the development of heterotopic ossification after total disk replacement include spinal level, sex, age, and prosthesis type. Locating definite risk factors for heterotopic ossification formation after the placement of interspinous devices was difficult. In the current case, the authors speculated that the heterotopic ossification was related to old age, spinal hypertrophic osteoarthritis, decreased interspinous space, and implant type.

One reason for the low occurrence rate of heterotopic ossification after the placement of interspinous devices could be the lack of long-term clinical follow-up. The clinical application of Coflex is currently in its early stage. Most studies only reported short-term clinical results. Another reason for the low occurrence rate might be that minor heterotopic ossification formation cannot be detected through routine radiographs. During a revision surgery for a patient previously treated with the X-stop device, Miller et al. reported that reactive osteophytes had developed bilaterally where the spinous process contacted the spacer. The true prevalence of heterotopic ossification after the placement of interspinous devices is unknown, but more such fusions should be expected as more time passes. Spontaneous fusion after the placement of an interspinous device could be a potential complication in mid- and long-term follow-up.

REFERENCES