Original Article

Prevalence and treatment of facet syndrome in patients with lumbar spinal stenosis managed with posterior lumbar vertebral spinal stabilization FFX® facet cages

ABSTRACT

Background: Facet joint degeneration represents a common source of low back pain and contributes to the development of lumbar spinal stenosis (LSS). We sought to identify the prevalence of facet syndrome in patients with LSS planned to undergo decompression and placement of facet cages (FFX® device, SC Medica) and the relationship of medial branch block (MBB) test results with postoperative visual analog scale (VAS) pain scores.

Materials and Methods: LSS patients undergoing decompression and placement of facet cages performed for a period of 1 year were included. Patients who did not undergo an MBB test prior to surgery were excluded.

Results: A total of 22 patients met the inclusion criteria for the study. The mean age was 69.4 ± 12.9 years with a majority of patients (63.6%) being female. Sixteen of the 22 (73%) patients had a positive MBB test. VAS scores were similar at baseline between the MBB positive and negative subgroups. The improvement in postoperative VAS back scores compared to baseline was greater for patients with a positive block test compared to those with a negative test (−4.7 vs. −1.8, respectively). As expected with the decompression part of the procedure, the improvement of VAS leg scores was similar for patients with positive and negative block tests compared to baseline.

Conclusion: The present study documents the high prevalence of facet syndrome in patients with LSS and the clinical benefits associated with the use of facet fusion cages to reduce facet-generated back pain.

Keywords: Facet joint, facet syndrome, FFX, fusion, lumbar spinal stenosis

INTRODUCTION

Facet joint degeneration represents one of the most common sources of low back pain, accounting for 27% – 40% of cases.[1-3] The facet (zygapophyseal) joints play an important role in spinal stability and the loss of synovial joint space, narrowing, loss of synovial fluid and the loss of cartilage and bony overgrowth of the joint are strongly related to different degenerative disorders of the lumbar spine that cause low back pain.[4]

Facet-generated pain, or facet syndrome, is often present with other degenerative disorders with several lines of evidence suggesting that the facet joint can be directly considered as a possible cause of lumbar stenosis.[4] The degenerative changes that cause facet syndrome can lead to overgrowth (hypertrophy) of the facet joints leading to the narrowing of the interfacet distance and the spinal canal, which can result in lumbar spinal stenosis (LSS). Additional

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pathophysiologic changes can also include decreases in disc height and bulging of the annulus fibrosus and posterior longitudinal ligament.[5]

It is challenging to accurately estimate the rate of facet joint degeneration among back pain patients despite the utility of imaging modalities for clinical back pain. Certain patients may have a lack of specificity in their low back pain symptoms because facet joints might mimic the discomfort associated with compressed roots or herniated discs. As a result, a medial branch block (MBB) with a local anesthetic is often used to confirm the facet joints as the source of low back pain. Unfortunately, there are divergent views regarding the definition of a positive diagnostic block, the number of blocks which should be given, as well as a high false positive rate associated with the procedure.[6]

While the first line of treatments of lower back pain are conservative options including physical therapy, oral anti-inflammatory medications, and epidural steroid injections, these only provide short-term benefits and do not directly treat the cause of the pain related to the motion causing inflammation in degenerative facet joints.[7] For patients with facet syndrome who have developed LSS with accompanying leg pain, surgical decompression is commonly performed after failure of conservative therapies. Surgical decompression combined with facet stabilization and fusion is considered a viable option to address facet-generated back pain and accompanying LSS-associated leg pain.

In line with the concept of facet intra-articular spacers introduced in the 2000s in the cervical spine,[8] the FFX® device (SC Medica, Strasbourg, France) is a posterior lumbar stabilization facet cage that is designed to prevent spinal instability and facet motion by enabling facet joint fusion [Figure 1].[9,10] Two devices are surgically implanted between the facet joints per level in conjunction with a facet screw and bone graft material placed inside and posterior to the implant [Figure 2].

The present study was undertaken to assess the prevalence of facet syndrome in patients with LSS who underwent implantation with posterior lumbar facet cages and the correlation between pain reduction following preoperative MBB and postoperatively after placement of the facet cages.

MATERIALS AND METHODS

The medical records of all patients undergoing lumbar spinal decompression and placement of posterior lumbar vertebral spinal stabilization facet cages performed at the authors' institution between September 2022 and August 2023 were retrospectively analyzed. Inclusion criteria for this study included patients undergoing their first lumbar spine surgery, up to grade I spondylolisthesis, and the absence of scoliosis (Cobb angle $<25°$). Patients were excluded if they did not have an MBB test prior to surgery. Data extracted from the patient's records included age, body mass index (BMI), gender, number of levels, spine segments operated on, and visual analog scale (VAS) scores.

Facet joint block test

Patients were placed in the prone position, and the injection site was cleaned and prepared using sterile techniques to reduce the risk of infection. Fluoroscopic guidance was used to ensure accurate needle placement near the targeted facet joint. After lidocaine was administered as a local anesthetic, a spinal needle was inserted through the skin and guided toward the base of the transverse process of the facet joint near the medial branch nerve that supplies

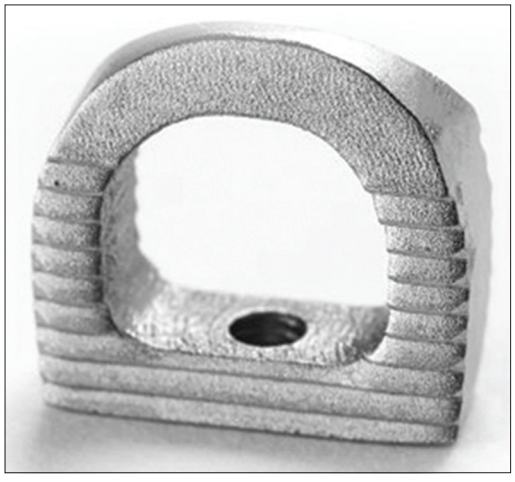

Figure 1: Posterior lumbar vertebral spinal stabilization facet cage (FFX® Device, SC Medica, Strasbourg, France)

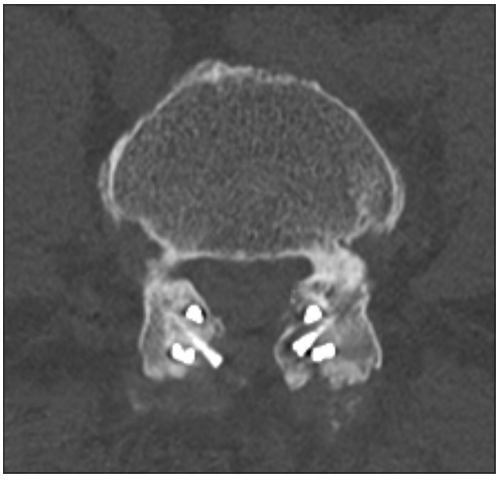

Figure 2: Bilateral implantation of FFX with facet screws between facet joints

the joint [Figure 3]. The placement of the needle was then confirmed using fluoroscopy. A small amount of contrast dye was then injected under fluoroscopic guidance to confirm that the needle was correctly placed. Once proper needle placement was confirmed, 2% lidocaine was injected around the medial branch nerve, followed by 4 mg of betamethasone (Célesténe, Sanofi, Paris, France).

If multiple levels were planned for surgical decompression, the first block was administered to the lowest affected level. Pain assessment was performed after the patients underwent lateral bending and palpation of the paraspinal region. The patient was asked to stand up and indicate if the pain was definitely or completely relieved. If there was still substantial pain, the patient would be repositioned in the prone position and the process repeated incremental for the next affected level planned for surgical decompression.

VAS scores were used to assess the patient's pain prior to and after the MBB test and after the LSS surgery with decompression and facet cages.[11] The block test was considered positive if the VAS back score decreased by 50% or more after the test was administered or if the combined VAS back and leg score decreased by 50+%.[12]

Operative technique

The facet cages were implanted bilaterally at each level via an open surgical approach following decompression. Tracking of the articular line spacing for each facet was performed with a facet chisel, followed by a reviving of the facet joints with a rasp to promote fusion. Following sizing to ensure proper device fit into the joint space, the appropriately sized implant was placed on the facet holder, and bone graft material was inserted into the empty space of the device. While attached to the facet holders and at the entry of the articular lines, the devices were inserted into the facet joint simultaneously on the right and left sides. The devices were then pushed into place using a supplied impactor and positioned appropriately.

After each facet cage was placed, a self-compressing facet screw was inserted in the previously prepared axis until the screw head was embedded in the articular mass. Autologous graft material was then added posterior to the facet cage.

Statistical analysis

Quantitative variables are presented as means ± standard deviation and categorical variables are summarized as percentages.

RESULTS

A total of 37 patients met the inclusion criteria for the study. Fifteen patients were excluded as a result of not having a facet block test performed prior to implantation of facet cage. Causes for not performing the block test included a sudden peak in pain requiring to perform the surgery earlier, patient cancellations, contraindications, and logistical reasons. Patient and operative characteristics for the 22 patients included in the final analysis are shown in Table 1. The mean age was 69.4 ± 12.9 years with a majority of patients (63.6%) being female.

Sixteen of the 22 patients (72.7%) had a positive MBB test with a block administered to a mean of 1.7 ± 0.7 levels. Table 1 separately reports the characteristics and operative details for patients with a positive or negative block test. Patients with a negative block test were more likely to be female, younger, and have a lower BMI than those with a positive test. There was no difference in the number of levels blocked for patients with a positive test compared to those with a negative test (1.8 ± 0.7 vs. 1.7 ± 0.5, respectively) or the number of levels operated on (1.8 ± 0.8 vs. 1.8 ± 0.9, respectively).

Figure 4 shows the patient-reported mean VAS back and leg pain scores prior to and after administration of the facet block and postoperatively for the total patient population and for patients with positive and negative block tests. VAS

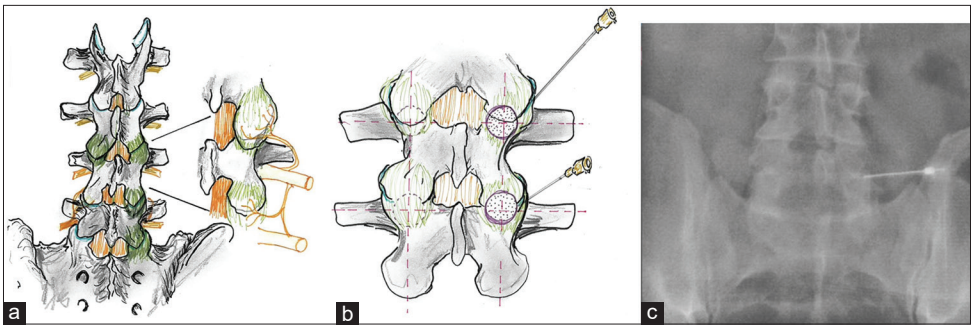

Figure 3: Lumbar medial branch nerve block. (a) illustration showing posterior and lateral views of the lumbar spine highlights the facet joints and medial branch nerves. (b) illustration of the site of needle insertion near the medial branch nerves when performing a facet joint block. (c) fluoroscopic image showing the location of needle insertion for a facet joint block

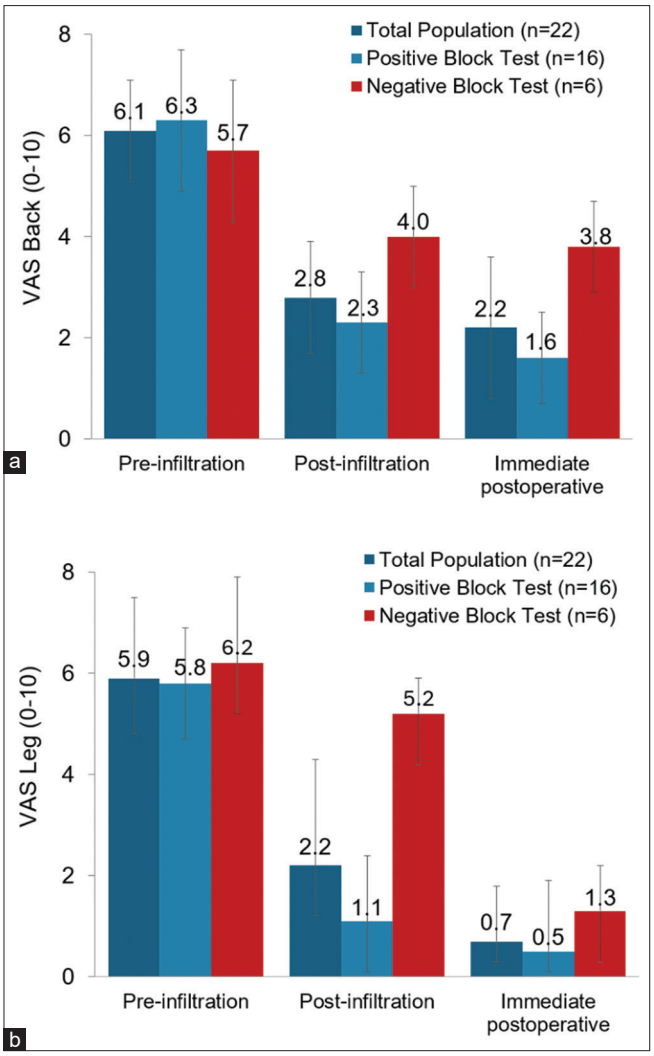

Figure 4: Visual Analog Scale (VAS) scores prior to and after facet block and postoperatively for (a) VAS Back Scores, and (b) VAS Leg Scores

back scores improved from 6.1 ± 1.0 preblock to 2.2 ± 1.4 postoperatively for the overall patient population. The improvement in postoperative VAS back scores compared to baseline was greater for patients with a positive block test compared to those with a negative test (−4.7 vs. −1.8, respectively). VAS leg scores improved from 5.9 ± 1.6 preblock to 0.7 ± 1.1 postoperatively for the overall patient population. The improvement for patients with positive and negative block tests compared to baseline was similar (−5.3 vs. −4.8, respectively).

Tables 2 and 3 report the baseline and postoperative VAS back and leg scores for the total population and by patients operated on a single level or more than one level, and separately for patients with positive and negative facet blocks. While all VAS scores improved compared to baseline independent of the number of levels operated on or whether the patient had a positive or negative block test, there is a similar result for each subgroup as noted above relative to a greater improvement in VAS back scores for patients with a positive versus a negative block and similar scores for VAS leg for both patient groups.

DISCUSSION

Facet instability has been proposed as a possible primary factor that contributes to the pathophysiology of lumbar spinal canal stenosis in a large percentage of patients with low back pain.[5] Degenerative changes of the facet joint can lead to hypertrophy of the joints which results in a narrowing of the interfacet distance and the spinal canal, leading to LSS. This facet instability and abnormal motion of the facets can lead to inflammation and pain emanating from the facet joint, which can be diagnosed by performing an MBB test. The present study supports this hypothesis with over 70% of patients undergoing LSS surgery being diagnosed with facet syndrome preoperatively as a result of a positive MBB test.

While patients with both positive and negative block tests in the current study had a reduction in postoperative VAS back and leg scores compared to baseline following placement of facet cages, the greater reduction in postoperative VAS back scores for patients with positive block test compared to those with a negative block test further supports the role of facet joint degeneration as a primary back pain generator in LSS. The ability of facet cages to block facet motion, causing inflammation, contributes to this reduction in lower back pain following the procedure. In other words, the present results contribute to our view that back pain in stenosis patients originates from three main sources:[1] dura mater compression (relieved by the surgical decompression),[2] disc protrusion (generally not at stake in stenosis elderly patients with reduced disc heights), and facet joint instability.[3] With regards to leg pain, while facet-generated pain can sometimes radiate to the buttocks or thighs in addition to the lower back, leg pain in a stenosis patient is primarily due to nerve root compression, which is relieved by the surgical decompression.

Pedicle screw fixation following decompression has historically been considered the standard technique for achieving fusion and spinal stability in patients with LSS.[13] The reduction in postoperative VAS scores observed in the present study is consistent with the 1-year and long-term results previously reported using the same posterior lumbar vertebral spinal stabilization facet cages.[9,10] These prior studies also demonstrated that the use of facet cages was able to achieve similar fusion rates as with pedicle screws without increased procedural risks. Placement of pedicle screws via open lumbar surgery using a posterior approach is

Table 1: Patient and operative characteristics

Characteristic	Total population (*n*=22)	Positive facet block test (*n*=16)	Negative facet block test (*n*=6)
Age (years); mean±SD (range)	69.4±12.9 (26–87)	69.3±13.3 (26–87)	61.5±14.0 (44–82)
Sex, *n* (%)			
Male	8 (38.4)	7 (43.8)	1 (16.7)
Female	14 (63.6)	9 (56.3)	5 (83.3)
BMI; mean±SD (range)	28.1±5.0 (21.0–37.0)	29.9±5.0 (21.0–37.0)	24.8±2.4 (22.0–27.7)
Number of levels blocked, mean±SD (range)	1.7±0.7 (1–3)	1.8±0.8 (1–3)	1.7±0.5 (1–2)
Number of levels surgery performed on, mean±SD (range)	1.8±0.8 (1–3)	1.8±0.8 (1–3)	1.8±0.8 (1–3)
Levels surgery performed on			
L3–L4	2	2	0
L4–L5	6	4	2
L5–S1	2	1	1
L2–L3–L4	1	1	0
L3–L4–L5	2	1	1
L4–L5–S1	3	3	0
L2–L3–L4–L5	1	1	0
L3–L4–L5–S1	5	3	2

SD: Standard deviation, BMI: Body mass index

Table 2: Visual Analog Scale back scores at baseline and postoperatively

	Number of patients	Baseline*	Postoperative*	Difference
Total population	22	5.7±1.6	2.2±1.5	−3.5
1 level	10	6.2±0.9	2.4±0.7	−4.0
>1 level	12	6.1±1.1	2.1±0.8	−4.0
Facet block test positive	16	6.3±0.8	1.6±1.1	−4.7
1 level	7	6.1±0.8	1.6±1.0	−4.5
>1 level	9	6.4±0.7	1.7±1.1	−4.7
Facet block test negative	6	5.7±1.4	3.8±0.9	−1.9
1 level	3	6.3±0.9	4.3±0.5	−2.0
>1 level	3	5.0±1.4	3.3±0.2	−1.7

*Reported as mean values±standard deviation

Table 3: Visual Analog Scale leg scores at baseline and postoperatively

	Number of patients	Baseline*	Postoperative*	Difference
Total population	22	5.5±2.1	0.8±1.0	−4.7
1 level	10	6.6±0.8	0.7±1.2	−5.9
>1 level	12	5.3±1.8	0.8±1.0	−4.5
Facet block test positive	16	5.8±1.7	0.5±0.9	−5.3
1 level	7	6.6±0.9	0.1±0.3	−6.5
>1 level	9	5.1±1.9	0.8±1.0	−4.3
Facet block test negative	6	6.2±1.1	1.3±1.4	−4.9
1 level	3	6.7±0.5	2.0±1.4	−4.7
>1 level	3	5.7±0.2	0.7±0.5	−5.0

*Reported as mean values±standard deviation

associated with significant soft tissue damage and blood loss with an increased risk of postoperative infections, hematoma formation within the spinal canal, and blood transfusion.[14,15] A nonrandomized, retrospective study demonstrated a reduction in mean operative time and estimated blood loss for patients undergoing posterior lumbar fusion surgery with fact cages compared to pedicle screw fixation.[16] The less rigid fixation and reduced load associated with the facet cages compared to pedicle screws can result in less adjacent segment degeneration and a reduced need for subsequent surgical procedures.[10,17]

There are several potential limitations associated with the present study. This includes the retrospective, nonrandomized study design and the enrollment of a limited number of patients from a single center. There are also differing opinions on what

constitutes a positive MBB test, the number of facet blocks that need to be performed, the difference in pain prior to and after the block, and the timing for evaluating the outcome of the diagnostic blocks. Since two sets of diagnostic MBBs are recommended by the International Pain and Spine Intervention Society as the most reliable method for identifying facet joint pathology, the use of only one block in the present study could have resulted in false-positive results.[18,19] Future studies should also explore the influence of performing decompression and facet fusion using a fully minimally invasive approach in these patients with the magnitude and speed of pain reduction when using an open approach.

CONCLUSION

The results of the present study support the significant role facet joint degeneration has in the pathophysiology of LSS. The use of facet cages to achieve posterior lumbar vertebral spinal stabilization and fusion in these patients can enable a reduction in low back pain as measured by VAS scores.

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Nil.

Conflicts of interest

Robin Srour reports having a relative that is employed by SC Medica and being a designer in the patents of the technologies. The remaining authors report no conflicts of interest.

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