

# “Only fixation” in cases with failed decompression for lumbar canal stenosis – Analysis of outcome in 14 cases

## ABSTRACT

**Aim:** The rationale of “only fixation” of affected spinal segments without any form of bone or soft-tissue decompression in cases with failed decompressive laminectomy for lumbar canal stenosis is discussed on the basis of an experience with 14 cases.

**Materials and Methods:** During the period between 2010 and 2022, 14 patients who symptomatically worsened or did not improve following a long-segment “wide” decompressive laminectomy for multisegmental lumbar canal stenosis were identified. All patients were treated by segmental spinal stabilization aimed at arthrodesis by facet distraction by Goel’s facet spacers (6 cases) or Camille’s transarticular facet fixation (8 cases). No bone, soft tissue, or disc resection was done for spinal or neural canal “decompression.” Oswestry Disability Index and Visual Analog Scale were used to clinically assess the patients before and after the surgery and at follow-up. In addition, video recordings of patient’s self-assessment of clinical outcome were used to monitor the outcome.

**Results:** During the average period of follow-up of 71 months (range 6 months to 16 years), all patients recovered in majority of their major symptoms, the recovery was observed in the immediate postoperative period. During the period of follow-up, none of the patients complained of recurrent symptoms or needed any additional surgery. There was firm stabilization and evidences of bone fusion of the treated spinal segments in all patients. There were no infections or implant failure. No patient worsened after treatment.

**Conclusions:** Instability of the spinal segments is the primary issue in cases with lumbar canal stenosis and stabilization in the treatment.

**Keywords:** Decompression, facet spacer, failed lumbar, fixation, transarticular fixation

## INTRODUCTION

While decompressive laminectomy is the gold standard and universally accepted form of surgical treatment for lumbar canal stenosis, failure of relief from some or all symptoms have been identified in at least 10%–20% percent of cases in the reported series.<sup>1,2</sup> Surgical treatment of failed decompressive laminectomy surgery has remained controversial, with some groups suggesting widening of decompression and/or extending the levels of decompression while others suggesting inclusion of fusion of selected spinal segments following additional decompression.

Standing human position lays life-long burden more prominently on extensor muscles located in the nape of neck and on the back of spine. The activity of these muscles is focused on the facets. In 2010, we identified that muscle weakness related to

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**Submitted:** 07-Nov-23


**Accepted:** 10-Nov-23

**Published:** 29-Nov-23

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**How to cite this article:** Goel A, Prasad A, Shah A, Maheshwari S, Vutha R. “Only fixation” in cases with failed decompression for lumbar canal stenosis – Analysis of outcome in 14 cases. J Craniovertebr Jun Spine 2023;14:330-5.

Access this article online	
<b>Website:</b> www.jcvjs.com	<b>Quick Response Code</b> 
<b>DOI:</b> 10.4103/jcvjs.jcvjs_151_23	

their disuse, misuse, or injury leads to listhesis or telescoping of the facets or “vertical” spinal instability.<sup>[3-7]</sup> Our articles observe that such vertical instability of the spinal segment/s forms the nodal point of pathogenesis of degenerative spinal changes in the entire spinal column.<sup>[6,7]</sup> Disc space reduction, disc bulges, ligamentum flavum buckling, osteophyte formation, and several similar alterations that eventually lead to spinal and neural canal “stenosis” are all the secondary consequences of vertical spinal instability. We identified that all these alterations are secondary, naturally protective and potentially reversible following surgery that involves stabilization of the involved spinal segments.<sup>[3-6]</sup> In 2013, we identified facet distraction with intra-articular spacers for stabilization of the facets in distracted position aiming for secondary decompression and arthrodesis of the affected spinal segment/s as a novel treatment strategy for lumbar canal stenosis.<sup>[6]</sup> In 2014, we proposed “only-fixation” as treatment for lumbar canal stenosis by transarticular Camille’s technique of fixation.<sup>[8]</sup> Both these treatment formats involve only-fixation aiming for arthrodesis of the spinal segments and identified the futility of any kind of direct bone, soft tissue, or disc resection for decompression. We now present our results of such treatment strategies in cases with lumbar canal stenosis where the earlier surgery that involved decompression by “wide” laminectomy had failed to provide desirable clinical outcome.

## MATERIALS AND METHODS

During the period to January 2010–September 2022, 14 cases were identified where the earlier surgical treatment of decompressive laminectomy for lumbar canal stenosis had failed and the patients had recurrent symptoms after an initial relief (seven patients), continued to have disabling symptoms (four patients), had worsened in symptoms (two patients) or had additional related clinical symptoms (one patient). Decompressive surgery was done in other institutions or surgical departments and not by the authors. This is a retrospective analysis of these 14 consecutively treated cases. Average follow-up is of 71 months. All patients were duly explained about the intended surgical procedure and provided written informed consent before surgery. All clinical tests and surgical procedures were conducted according to the principles of Declaration of Helsinki. Whilst facet distraction technique using intra-articular spacers was deployed from 2006 to 2011 (6 cases), “only fixation technique” by deploying transarticular screws (Camille’s technique) was used from 2011 onward (8 cases).

There were 7 males and 7 females and their ages ranged from 33 to 73 years (average 54 years). Table 1 summarizes the presenting clinical features. All patients had characteristic clinical symptoms and radiological indicators that are generally attributed to lumbar canal stenosis and included claudication

pain (14 patients), static backache or backache even at rest that radiated to posterior aspect of the legs (14 patients), weakness of muscle groups (three patients), paraesthesiae in the distribution of one or more nerve roots (12 patients). Two patients had difficulty in walking and three patients were not able to walk unaided due to the severity of pain. All patients were investigated with magnetic resonance imaging and computed tomography scan and plain radiographs. Table 1 summarizes the radiological observations. There was no evidence of any radiological instability on static or dynamic imaging. Patients having any grade of spondylolisthesis were excluded from the study. Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) were used to grade the symptoms [Tables 2 and 3].

## Surgery

The subtleties of techniques of intra-articular spacer insertion and transarticular fixation techniques have been

**Table 1: Presenting clinical and radiological features**

Clinical and Radiological Parameter	Number of patients
Sex	
Male	7
Female	7
Mean age	
Symptoms	
Back pain	14
Intermittent claudication	14
Sensory deficits	3
Motor deficits	3
Bladder and bowel involvement	2
Levels of involvement	
L1–L2	1
L2–L3	6
L3–L4	9
L4–L5	14
L5–S1	5
Number of levels fixed	
Two	4
Three	7
Four	3

**Table 2: Preoperative and postoperative Oswestry Disability Index**

Score (%)	Preoperative (number of patients)	Postoperative (at 6 months) (number of patients)
10–20	-	11
20–30	-	3
30–40	3	-
40–50	8	-
50–60	3	-

**Table 3: Preoperative and postoperative Visual Analog Scale**

VAS score	Preoperative	Postoperative (6 months)
Back pain	8.2 (6–9)	0.4 (0–5)

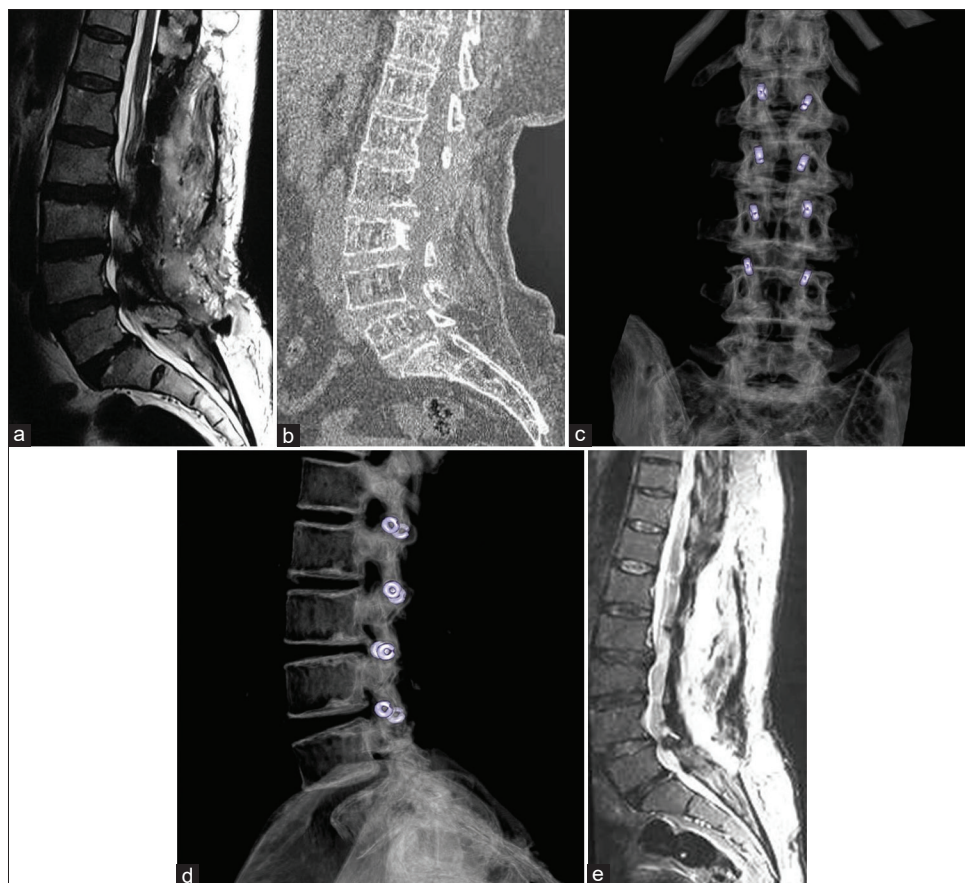
VAS - Visual Analog Scale

detailed by us earlier and are briefly summarized.<sup>[5,6,8-10]</sup> All patients were re-operated in prone surgical position and the operation table was appropriately maneuvered to keep the back flat and flexed and obliterated or reduced the lumbar lordosis. Among adhesions due to previous surgery, the facets were widely exposed. Intra-articular spacer and Camille's transarticular screw fixation techniques were adopted even in cases where the facet was partially violated during the previous surgery [Figures 1 and 2]. Complete facetal resection during the previous surgery was not observed in any case. Manual manipulation of bones during operation confirmed instability of spinal levels that was suspected on radiological imaging and clinical indicators. Intraoperative observation of open facetal articulation, facetal listhesis, and osteophyte or abnormal bone formation in the vicinity of the articular surfaces of facets were additional features that suggested instability of the spinal segment. The levels of fixation that were done are shown in Table 1. The fixation was extended beyond the previously decompressed spinal segments by a single level in three patients, two levels in seven patients, three levels in three patients, and four levels in one patient. The sizes of intra-articular spacers were 2–3 mm in thickness

and 10 mm in diameter. For Camille's technique, two screws (double insurance) were used at 34 levels (68 facetal articulations) and three screws (triple insurance) were used at 7 levels (14 facetal articulations). Self-tapping monoaxial screws were approximately 18 mm long and 2.6 mm in diameter. No additional decompression by resection of any part of bone over the spinal or neural canal, soft tissue or disc was done. After fixation, all the exposed bones of the laminae and facets were decorticated to prepare the host bone for fusion-arthrodesis. Bone graft was harvested from the spinous processes available in the treated or adjoining segments that were sectioned at their base, cut into small pieces and placed over the host bone. The patients were mobilized as soon as was possible and were advised to restrict physical activities particularly those involving movements of back for a period of 6 weeks.

## RESULTS

The follow-up ranged from 5 to 16 years (average 71 months). The clinical outcome was assessed by two independent and qualified neurosurgeons who were not authors of the



**Figure 1:** Images of 59 years old female was operated twice earlier by decompressive laminectomy 12 and 4 years before current operation. (a) Preoperative T2-weighted magnetic resonance imaging (MRI) showing characteristic features of lumbar canal stenosis. (b) Preoperative computed tomographyscan showing evidence of previous laminectomy. (c) Postoperative anteroposterior view of X-Ray done 18 months after surgery showing facetal spacers in L1-2, L2-3, L3-4 and L4-5 facets. (d) Postoperative lateral X-ray showing the spacers. (e) Postoperative MRI showing enlargement of the lumbar spinal canal



**Figure 2: Images of a 47 year old female patient who was operated 6 months ago by endoscopic decompressive laminectomy for lumbar canal stenosis. (a) T2-weighted magnetic resonance imaging shows characteristic radiological features of lumbar canal stenosis. (b) Sagittal computed tomography (CT) scan shows some evidence of bone decompression. (c) Sagittal CT scan cut through the facets showing intact facet articulation. (d) Postoperative CT scan showing transarticular screw fixation**

article. VAS and ODI score were used to assess all patients. In addition, video recordings of interviews with the patient and a patient self-assessment questionnaire were used to assess the clinical outcome. All patients improved in “majority” of their presenting related symptoms. Recovery in the symptoms was observed soon after awakening from surgery. None of the symptoms recurred at follow-up. Arthrodesis of the treated spinal segments was considered to be successful when the clinical improvement was sustained, intra-articular spacers or the screws retained their alignment and position, bone fusion was observed across the facets and there was no relative movement of spinal segments on dynamic imaging that involved forced flexion and extension movements. With these basic parameters, bone fusion was confirmed at all the treated spinal segments. There were no infections or any other issue that suggested treatment failure and warranted reoperation.

## DISCUSSION

Lumbar canal stenosis is a common clinical condition. Approximately 20% of population over the age of 60 years develops symptoms related to lumbar canal stenosis.<sup>[11,12]</sup> Surgery for lumbar canal stenosis is one of the most frequently performed procedures on the spine. “Stenosis” of the lumbar spinal canal has been traditionally identified to be the issue and “decompression” by laminectomy is the standard and

accepted form of surgical treatment for decades. Surgery for failed decompression for lumbar canal stenosis can be a therapeutic challenge. Extension of decompression has been the primary form of treatment. More recently, some surgeons add stabilization of the treated segments.<sup>[1,2,12]</sup> However, controversy regarding the most optimal form of treatment continues.

Weakness of the muscles that partake in life-long human standing position related to their disuse, abuse or injury initiate a cascade of events that ultimately lead to spinal instability. The instability is “vertical” and results in telescoping or listhesis of the spinal segments.<sup>[7]</sup> Reduction of the intervertebral disc space, bulging of the disc into the spinal canal, buckling of the intervertebral ligaments that include posterior longitudinal ligament and ligamentum flavum, osteophytes formation, and the consequent reduction in the spinal and neural canal dimensions are the secondary events. Essentially, it was observed that all the so-called “pathological” events related to degenerative spinal disease are secondary or consequences of instability. Claudication pain was related to weakness of the muscles that give way after walking for a distance and subsequently results in lumbar canal stenosis and its characteristic manifestation of pain and paresthesiae over the back of the leg.<sup>[12]</sup> Rest pain and weakness of muscles of the legs are the eventual effects of untreated and neglected spinal instability. The syndrome of lumbar canal stenosis appears to be a dynamic phenomenon that worsens on exercising, walking for a distance, or after activities that lead to muscle fatigue-related spinal incompetence. As the instability is focused on the facet articulation, it is lateral to the spinal canal and away from the neural structures and can be subtle and it may be difficult or impossible to diagnose instability on the basis of dynamic computer-based imaging. On the other hand, the consequences of instability such as bulging discs, buckling posterior longitudinal ligament and ligamentum flavum, and osteophyte formation are seen clearly on imaging to be compressing the neural structures. Conventionally, stenosis of the lumbar canal is considered to be the issue in an otherwise stable spine. As compression has been recognized universally to be the offending issue, decompression has been the accepted form of surgical treatment. In variation with the traditional tenet, we observed that instability is the primary pathogenetic issue and stabilization or fixation-arthrodesis is the treatment. Although the issue of instability has been under discussion, its role as a primary pathogenetic issue has not been evaluated or clinically exploited.

In the year 2010, on the basis of the concept that vertical spinal instability related facet listhesis and telescoping of the spinal segments is the nodal point of pathogenesis of spinal

canal stenosis, we introduced facet distraction-arthrodesis technique using intra-articular spacers as a novel form of treatment of single or multiple level radiculopathy or myelopathy.<sup>[3-5]</sup> We used this technique effectively in the treatment of lumbar canal stenosis.<sup>[6]</sup> We recently reported our experience of treating cases with lumbar canal stenosis with only fixation using Camille's technique of transarticular fixation.<sup>[8,12-16]</sup> Both our techniques identified the role of stabilization and futility of decompression in the surgical treatment. On the basis of our observations, we preferred the nomenclature of lumbar spinal "instability" to lumbar canal "stenosis."<sup>[17]</sup> We identified similar surgical philosophy of "only fixation" ideal for radiculopathy or myelopathy related single or multiple level cervical spinal degeneration.<sup>[18]</sup> Our more than three decade experience of handling the facet articulation, initially of craniovertebral junction and later of subaxial spine has put us in advantageous position to assess the status of stability of the articulation and confirm the need for surgical stabilization.

The extent of facet resection for decompression will determine the nature of fixation in a case where decompressive surgery has already been done. All the patients in the presented series underwent intra-articular spacer distraction-fixation or a modified Camille's technique of fixation, irrespective of the extent of facet resection that was done on the earlier occasion. In the modified Camille's technique, two or double insurance screws (68 articulations - 34 levels) and three or triple insurance screws (14 articulations - 7 levels) were used for stabilization. Due to the ease and effectiveness of Camille's technique,<sup>[9,10]</sup> although possible and more popularly used, pedicular fixation was not done in any case. No additional bone or ligament resection was done for additional canal decompression. Apart from previously treated surgical levels, stabilization was done on the adjoining segments on the basis of radiological evidences of spinal degeneration or by direct assessment of instability by manual manipulation of the bones. Complete or even more than one-third violation of the facet was not observed at any level in any patient. Pedicular fixation using screws and rod will be mandatory in such an instance.

Clinical assessments, both preoperative and postoperative, were done on the basis of universally recognized ODI and VAS parameters. In addition, a personalized patient satisfaction score was used to assess the outcome of surgery. All the patients in the presented series had remarkable improvement and relief from their longstanding symptoms after the surgical treatment. The improvement started in the immediate postoperative period and was sustained. Similar results were obtained in our previously reported series wherein "only

fixation" was done as surgical treatment of patients having lumbar canal stenosis. Our remarkably gratifying clinical results reported in our earlier series involving both lumbar and cervical spinal canal stenosis and the 100% satisfactory outcome in the present experience are clearly suggestive of the validity of our proposed hypothesis and effectiveness of the surgical strategy that involves only spinal fixation without any form of direct or indirect spinal decompression.

## CONCLUSIONS

On the basis of the present and earlier experience, it is concluded that spinal instability is the primary point of genesis and the subsequent progression of spinal degeneration. Only spinal fixation of the facets that form the point of fulcrum of all spinal movements is a rational and effective surgical therapy.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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