

# Assessment of Clinical Outcome of Bilateral Decompression through Unilateral Approach in Lumbar Canal Stenosis

Emad H Abouelmaaty MD, Shafik El Molla MD.

*Department of Neurosurgery, Faculty of Medicine, Ain Shams University, Cairo, Egypt.*

## Abstract

**Background Data:** Acquired degenerative lumbar canal stenosis is considered a common indication for lumbar spine surgery in old patients. The traditional approach is wide open laminectomy, medial facetectomy, and foraminotomy, which includes bilateral muscle separation and extensive excision of the posterior spinal structures. Minimal invasive surgeries as microsurgical and endoscopic have been now used for the treatment of lumbar canal stenosis during the last years.

**Purpose:** To assess clinical outcome of unilateral approach in bilateral decompression of lumbar canal stenosis.

**Study Design:** Observational analytic prospective study.

**Patients and Methods:** Twenty patients with degenerative lumbar canal stenosis have undergone bilateral decompression from unilateral approach at Ain Shams university hospitals between May 2014 and April 2016. Prospective analysis of their clinical outcome was conducted.

**Results:** In this study twelve were male (60%) and eight were female (40%). The mean age was  $43.1 \pm 12.33$  (range 35-55 years). The duration of clinical presentation ranged from 6 to 24 months. Preoperative clinical presentation was low back pain (95%), sciatica (85%), neurogenic claudication (100%) and sensory changes (80%). Marked improvement of preoperative leg pain has been observed after surgical decompression. Significant reduction of the mean preoperative VAS ( $7 \pm 0.72$ ) (over all back and leg pain) to VAS

Received on:

November 4<sup>th</sup>, 2016

Accepted on:

December 22<sup>nd</sup>, 2016

( $2\pm 0.72$ ) at one, ( $1.85\pm 0.58$ ) at three and ( $1.6\pm 0.68$ ) at 6 months ( $P>0.001$ ). The mean ODI scores decreased significantly at one ( $27\pm 9.78$ ), three ( $23\pm 7.3$ ) and six months ( $21\pm 4.47$ ) from the mean preoperative ODI score ( $61\pm 4.47$ ) ( $P>0.0001$ ). Accidental durotomy was reported in one patient (5%) and it was in the posterior dura under the opposite lamina just off the midline.

**Conclusion:** Unilateral approach in bilateral decompression is an effective procedure for management of lumbar canal stenosis. (2016ESJ119)

**Keywords:** lumbar canal stenosis, degenerative, decompression, unilateral.

## Introduction

Acquired degenerative lumbar canal stenosis is considered a common indication for lumbar spine surgery in old patients.<sup>3,10</sup> Degenerative changes, as intervertebral disc bulge, ligamentum flavum thickening, and/or facet joint enlargement, cause neural compression in the central canal, intervertebral foramen, or lateral recess, causing pain, decreased function, and impaired quality of life.<sup>10,4</sup> Surgical intervention of lumbar canal stenosis is indicated after failure of conservative management. The traditional approach is a wide open laminectomy, medial facetectomy, and foraminotomy,<sup>2</sup> and includes bilateral muscle separation and extensive excision of the posterior spinal structures. While open decompression varies in its success rate, the wide bony and muscular disruption has many adverse effects, like instability, muscular weakness, and failed back syndrome.<sup>7</sup>

Minimal invasive surgeries as microsurgical and endoscopic have been now used for the treatment of lumbar canal stenosis during the last years. The aim of these procedures is to preserve the midline structures (spinous process, intra-spinous and supra-spinous ligaments) and facet joints, to prevent postoperative instability. Microsurgical bilateral decompression using a unilateral approach was introduced first by Poletti.<sup>9</sup> This procedure was after that modified and described in details by Mc Culloch and Young.<sup>6</sup> Using this procedure, both the dural sac and the nerve roots on each

side can be decompressed without any violation to the supra- or interspinous ligament complex and the contralateral paraspinal muscles and facet joints. Decompression of the central spinal canal is done by the undercutting of the laminae and resecting the ligamentum flavum on the contralateral side.<sup>14</sup>

This study aims to assess clinical outcome of unilateral approach in bilateral decompression of lumbar canal stenosis.

## Patients and Methods

Twenty patients with degenerative lumbar canal stenosis underwent bilateral decompression from unilateral approach at Ain Shams university hospitals between May 2014 and April 2016. Prospective analysis of their clinical outcome was conducted. All patients in this study have the following criteria: 1) Age ranged between 35 and 55 years. 2) Symptoms of neurogenic claudication related to radiologically evident one or two level degenerative lumbar canal stenosis. 3) Failure of conservative medical treatment for at least 3 months. 4) Absence of instability or spondylolisthesis on dynamic x ray. 5) No previous lumbar spine surgery.

Full neurological examination, dynamic (flexion/extension) lateral radiographs, CT and MRI lumbosacral spine (LSS) were done for all patients before surgery. Postoperative CT-scan of the LSS was performed for all patients before hospital discharge and MRI and dynamic lateral radiographs LSS was performed after one month to evaluate adequacy of the decompression and

stability respectively. All patients were followed up 1, 3 and 6 months after surgery with full neurological examination and assessment of back and leg pains.

Outcome assessment of surgery was based on VAS, ODI and subjective patient satisfaction measurement. Pain was assessed pre- and post-operatively by subjective 10 points VAS. Disability was assessed by ODI.

#### **Surgical Procedure:**

Midline 3-5cm skin incision is made according to the level of stenosis (one or two levels) guided by intraoperative C arm fluoroscopy. A linear median fascial incision is made on the patient's most symptomatic side. Separation of the paraspinal muscles from the spinous process and lamina to expose the bony structures. Unilateral self-retaining muscle retractor is inserted. A fenestration is done using Kerrison rongeurs and/or high speed diamond burr. The microscope is used to complete decompression of the spinal canal. Ligamentum flavum and bony stenosing pathology are removed by Kerrison rongeurs until we see the exiting root through the foramen. Care should be paid to spare the pars interarticularis, facet joint and facet joint capsule. After finishing ipsilateral decompression, the microscope is angulated medially and contralaterally to see the opposite side across the midline. The patient is also tilted to the contralateral side (The patient is tied safely to the operating table before starting the operation). Partial removal of the undersurface of the spinous process was performed to get good visualization of the contralateral side safely. Dissecting the anterior surface of the ligamentum flavum from the underlying dura and then the ligament is removed using Kerrison rongeurs from medial to lateral and from cephalad to caudal. At the end of the contralateral decompression, the

contralateral exiting root is visualized and its foramen decompression is confirmed by passing a dissector in the direction of the contralateral exiting root. Hemostasis and closure of all layers with subfascial suction drain.

The patient was mobilized out of bed without lumbosacral belt at the night of surgery or on the next day morning. The patient was usually discharged after 24 hours and after removal of the wound drain.

Statistical analysis was performed with SPSS software to assess the outcome results.

## **Results**

In this twenty patients study, twelve were male (60%) and eight were female (40%). The mean age was  $43.1 \pm 12.33$  (range 35-55years). The duration of clinical presentation ranged from 6 to 24 months. Preoperative clinical presentation was low back pain (95%), sciatica (85%), neurogenic claudication (100%) and sensory changes (80%). The operated levels of lumbar canal stenosis were: L2-3 (two patients), L3-4 (nine patients), L4-5 (seventeen patients), L5-S1 (two patients). Of ten patients with single stenotic level, nine was L4-5 and one L3-4. Of ten patients with two stenotic levels, six was (L3-4 & L4-5), Two (L2-3 & L3-4) and two (L4-5 & L5-S1). The minimum follow up was 6 months. (Table 1)

Accidental durotomy occurred in one patient (5%) and it was in the posterior dura under the opposite lamina just off the midline. It was the second patient of our series and due to inadequate dissection of the anterior surface of ligamentum flavum from the posterior dura. The tear was primarily repaired with covered with fat graft. The subfascial drain was put out of suction. The patient was instructed to stay in bed for 48 hours and was discharged on the fourth day after surgery. There were no other

intra or postoperative reported complications (neural injury, CSF leak or postoperative infection).

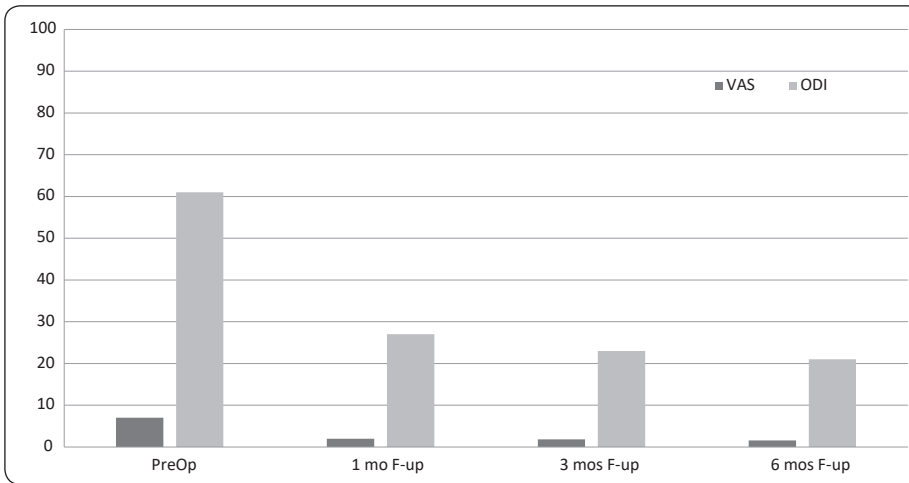
Marked improvement of preoperative leg pain was reported after surgical decompression. There was significant reduction of the mean VAS scores of overall pain (back and leg pain) at one ( $2\pm0.72$ ), three ( $1.85\pm0.58$ ) and six months ( $1.6\pm0.68$ ) from the mean preoperative VAS ( $7\pm0.72$ ) ( $P>0.001$ ). The mean ODI scores decreased significantly at one ( $27\pm9.78$ ), three ( $23\pm7.3$ ) and six months ( $21\pm4.47$ ) from the mean preoperative ODI score ( $61\pm4.47$ ) ( $P$  value  $>0.0001$ ). (Figure 1) Ninety five percent

of patients were satisfied with surgery outcome (surgery met their expectation and they would undergo the same surgery for the same results) while one patient (5%) was not satisfied (surgery helped but they would not undergo the same surgery for the same results). (Figure 2)

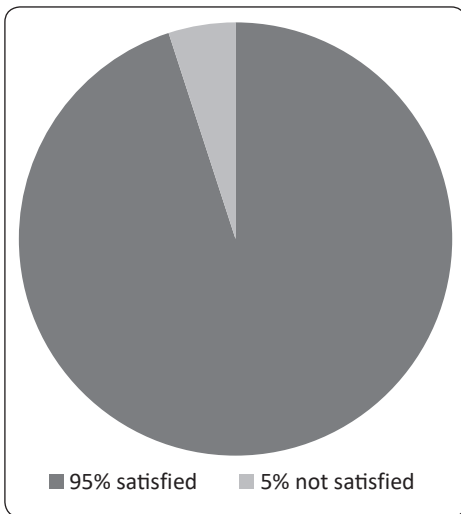
Postoperative CT scan, performed before discharge, revealed adequate decompression in all patients and this was re-confirmed at one month follow up by doing MRI. (Figures 3,4) No postoperative instability was reported in any of our patients on dynamic lateral X-ray done at one month follow up.

**Table 1.** Clinical and Demographic Patients Characteristics

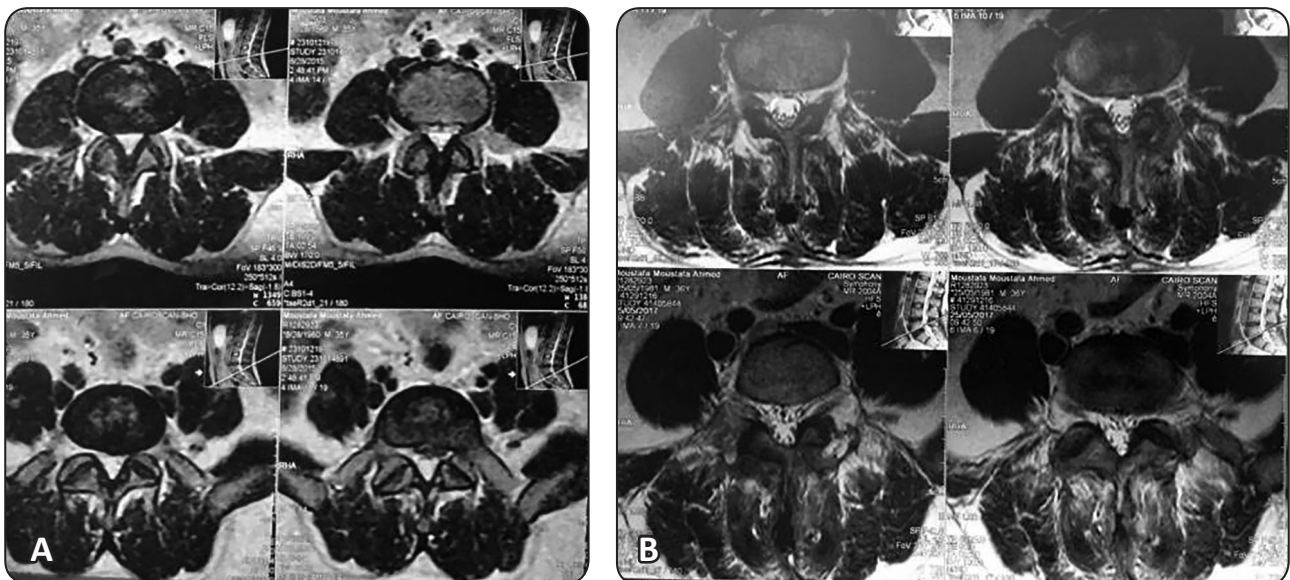
Parameters		Value
Number of patients		20
Male/ Female		12/8
Mean Age (Years)		43.1±12.3(35-55yrs)
Minimum follow up		6 months
Clinical Presentation	Low back pain	19 (95%)
	Sciatica	17 (85%)
	Neurogenic claudication	20 (100%)
	Sensory changes	16 (80%)
Operated stenotic level	L2-3	2 (10%)
	L3-4	9 (45%)
	L4-5	17 (85%)
	L5-S1	2 (10%)
No. of stenotic levels	One	10 (50%)
	Two	10 (50%)



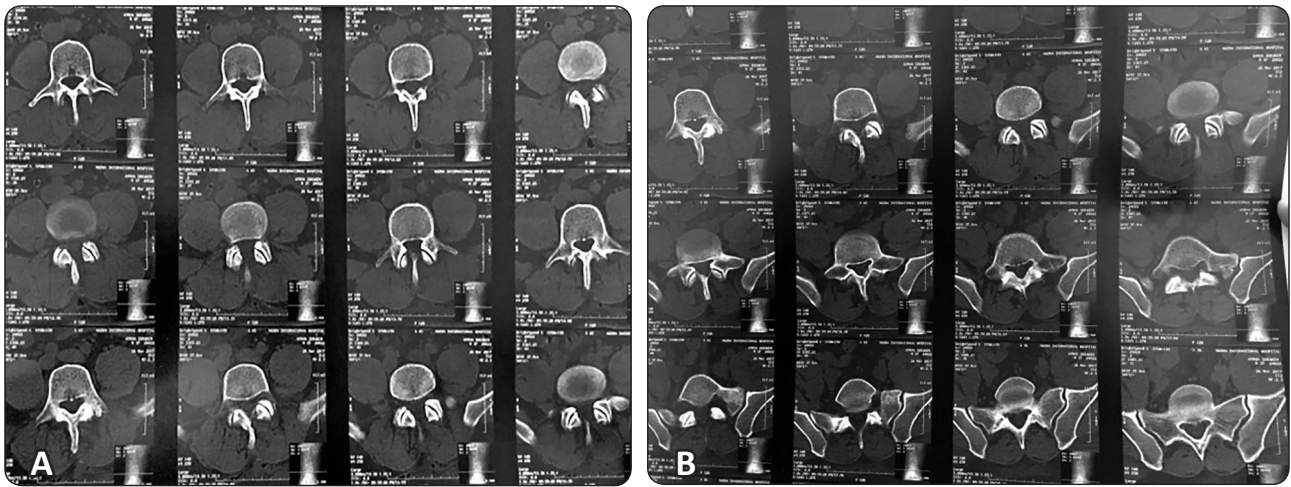
**Figure 1.**  
Pre and Postoperative VAS, ODI at 1, 3 and 6 Months Follow-up.



**Figure 2.**  
Patient Satisfaction with Surgery Outcome



**Figure 3.** (A) Preoperative MRI LSS showing lumbar canal stenosis L4-5 and L5-S1 (discogenic and ligamentous), (B) postoperative MRI LSS showing bilateral decompression of the lumbar canal at L4-5 AND L5-S1 from unilateral approach (left side)



**Figure 4.** Postoperative CT LSS showing bilateral lumbar canal stenosis decompression from unilateral approach (left side) at levels of L3-4 (A) and L4-5 (B)

## Discussion

Lumbar canal stenosis is considered a common problem in adult patients complaining from back pain and sciatica with intermittent claudication. If failure of conservative management occurs, surgical treatment should be considered, the most common of which is wide laminectomy.<sup>1</sup> Many authors<sup>12</sup> have reported good results with decompressive laminectomy. However, instability following wide laminectomy has become a problem. McCulloch and Young<sup>6</sup> used unilateral laminotomy for bilateral ligamentectomy and found a good or excellent outcome in 90.9% of the twenty two patients with lumbar canal stenosis. Weiner et al,<sup>13</sup> underwent limited laminectomy with spinous process undermining preserving the midline osseo-ligamentous structures, and they found that 87% of patients stated high rates of satisfaction at the follow-up. Thome et al,<sup>11</sup> reported clinical improvement after unilateral laminectomy equivalent to that reported with open conventional laminectomy during follow-up period of 12 months. Reporting the long-term clinical outcome of minimal invasive decompressive procedures,

Oertel et al,<sup>8</sup> reported that 85.3% of 102 patients had excellent to fair results over 4 to 10 years (mean=5.6 years) of follow-up, with a reoperation rate of 11.8%. Costa et al,<sup>4</sup> reported that 87.9% of 374 patients of their series experienced clinical improvement and only 8% of patients experienced segmental instability at the operated level at a mean duration of follow-up of 30.3 months (range, 16–53 months). Cavusoglu et al,<sup>3</sup> stated that good results were achieved in 68% of the patients at 4 years, and found that reoperation was not required for recurrent spinal stenosis at the operated levels within 4 to 7 years.

In this study, we evaluated clinical outcome and radiographic changes for twenty patients who have undergone bilateral decompression through unilateral approach. In our twenty patients series, twelve were male (60%) and eight were female (40%). The mean age was  $43.1 \pm 12.33$  (range 35-55years). The duration of clinical presentation ranged from 6 to 24 months. Preoperative clinical presentation was low back pain (95%), sciatica (85%), neurogenic claudication (100%) and sensory changes (80%). The operated levels of lumbar canal stenosis

were: L2-3 (two patients), L3-4 (nine patients), L4-5 (seventeen patients), L5-S1 (two patients). Of ten patients with single stenotic level, nine was L4-5 and one L3-4. Of ten patients with two stenotic levels, six was (L3-4 & L4-5), Two (L2-3 & L3-4) and two (L4-5 & L5-S1). The mean follow up was 6 months. The mean age was younger than other studies while the clinical picture presentation goes with them.<sup>12,5</sup>

There was marked improvement of postoperative leg pain after surgical decompression. There was significant reduction of the mean VAS scores of overall pain (back and leg pain) at one ( $2 \pm 0.72$ ), three ( $1.85 \pm 0.58$ ) and six months ( $1.6 \pm 0.68$ ) from the mean preoperative VAS ( $7 \pm 0.72$ ) ( $P > 0.001$ ). The mean ODI scores decreased significantly at one ( $27 \pm 9.78$ ), three ( $23 \pm 7.3$ ) and six months ( $21 \pm 4.47$ ) from the mean preoperative ODI score ( $61 \pm 4.47$ ) ( $P > 0.0001$ ). This marked improvement in VAS and ODI indicates that bilateral decompression using unilateral approach is an efficient technique in decompressing lumbar canal stenosis and improving the clinical picture of the patients. 95% of patients were satisfied with surgery outcome (surgery met their expectation and they would undergo the same surgery for the same results) while one patient (5%) was not satisfied (surgery helped but they would not undergo the same surgery for the same results). These results were similar to different studies.<sup>4,8</sup>

All the patients were followed up using dynamic x-ray and CT and MRI lumbosacral spine. There was no slippage noticed in any patient post-operatively. The CT and MRI showed adequate decompression. The rate of slippage was higher in other studies and this is may be due to the long term follow up in these studies compared to our series.<sup>5,15</sup>

Regarding this study there were different limitations including the relatively small number of patients and the short term follow up of the patients, but according to the results attained, it indicates that bilateral decompression using unilateral approach is an efficient technique in management of lumbar canal stenosis.

## Conclusion

Unilateral approach used for bilateral decompression is an effective procedure for management of lumbar canal stenosis.

## References

1. Alimi M, Hofstetter CP, Pyo SY, Paulo D, Härtl R: Minimally invasive laminectomy for lumbar spinal stenosis in patients with and without preoperative spondylolisthesis: clinical outcome and reoperation rates J Neurosurg Spine 22:339–352, 2015
2. Bouras T, Stranjalis G, Loufardaki M, Sourtzis I, Stavrinou LC, Sakas DE: Predictors of long-term outcome in an elderly group after laminectomy for lumbar stenosis. Clinical article. J Neurosurg Spine 13:329–334, 2010
3. Cavuşoğlu H, Kaya RA, Türkmenoglu ON, Tuncer C, Colak I, Aydin Y: Midterm outcome after unilateral approach for bilateral decompression of lumbar spinal stenosis: 5-year prospective study. Eur Spine J 16:2133–2142, 2007
4. Costa F, Sassi M, Cardia A, Ortolina A, De Santis A, Luccarell G, et al: Degenerative lumbar spinal stenosis: analysis of results in a series of 374 patients treated with unilateral laminotomy for bilateral microdecompression. J Neurosurg Spine 7:579–586, 2007
5. Ji YC, Kim YB, Hwang SN, Park SW, Kwon JT, Min BK: Efficacy of Unilateral Laminectomy for Bilateral Decompression

- in Elderly Lumbar Spinal Stenosis, *J Korean Neurosurgery* 58(5):410-415, 2005
6. McCulloch JA, Young PA: *Essentials of spinal microsurgery*. Philadelphia, PA: Lippincott-Raven; 1998
  7. Mobbs RJ, Li J, Sivabalan P, Raley D, and Rao PJ: Outcomes after decompressive laminectomy for lumbar spinal stenosis: comparison between minimally invasive unilateral laminectomy for bilateral decompression and open laminectomy. *J Neurosurg Spine* 21:179–186, 2014
  8. Oertel MF, Ryang YM, Korinth MC, Gilsbach JM, Rohde V: Long-term results of microsurgical treatment of lumbar spinal stenosis by unilateral laminotomy for bilateral decompression. *Neurosurgery* 59:1264–1269(discussion 1269–70), 2006
  9. Poletti CE: Central lumbar stenosis caused by ligamentum flavum: unilateral laminotomy for bilateral ligamentectomy: preliminary report of two cases. *Neurosurgery* 37:343–7, 1995
  10. Rosen DS, O’Toole JE, Eichholz KM, Hrubes M, Huo D, Sandhu FA, et al: Minimally invasive lumbar spinal decompression in the elderly: outcomes of 50 patients aged 75 years and older. *Neurosurgery* 60:503–510, 2007
  11. Thome C, Zevgaridis D, Leheta O, Bözner H, Pöckler-Schöniger C, Wöhrle J, Schmiedek P: Outcome after less-invasive decompression of lumbar spinal stenosis: a randomized comparison of unilateral laminotomy, bilateral laminotomy, and laminectomy. *J Neurosurg Spine* 3:129–41, 2005
  12. Toyoda H, Nakamura H, Konishi S, Dohzono S, Kato M and Matsuda H: Clinical Outcome of Microsurgical Bilateral Decompression via Unilateral Approach for Lumbar Canal Stenosis. *SPINE* Volume 36, Number 5, pp 410–415, 2011
  13. Weiner BK, Fraser RD, Peterson M: Spinous process osteotomies to facilitate lumbar decompressive surgery. *Spine* 24:62–6, 1999
  14. Weiner BK, Walker M, Brower RS, McCulloch JA: Microdecompression for lumbar spinal canal stenosis. *Spine* 24:2268–72, 1999
  15. Yoshida M, Minamide A, Maio K: The treatment strategy of lumbar spinal canal stenosis based on the natural course. *Spine Spinal Cord* 18:879–85, 2005

Address reprint  
request to:

**Emad H Abouelmaaty MD.**

Neurosurgery Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt  
Email: emadhamza77@hotmail.com



## الملخص العربي

### تقييم النتائج الإكلينيكية للمدخل الجراحي من ناحية واحدة لتخفيف الضغط علي الناحيتين في حالات ضيق القناة القطنية

**البيانات الخلفية:** يعد ضيق القناة القطنية الانطلاقي (التنكسي) المكتسب من الدواعي الشائعة لجراحات الفقرات القطنية في المرضى كبار السن. النهج التقليدي للجراحة هو استئصال الصفيحة القطنية بالكامل، استئصال الجزء الداخلي للمفصل الخلفي للفقرة القطنية وتوسيع مجري جذر العصب القطني بما في ذلك فصل العضلات الجانبية للعمود الفقري واستئصال واسع للبنية الخلفية للعمود الفقري (أثناء المدخل الجراحي). وقد استخدمت الجراحات محدودة التدخل مثل الجراحات الميكروسكوبية أو بالمنظار في السنوات الأخيرة لعلاج ضيق القناة القطنية.

**الغرض:** تقييم النتائج الإكلينيكية للمدخل الجراحي من ناحية واحدة لتخفيف الضغط علي الناحيتين في حالات ضيق القناة القطنية.

**تصميم الدراسة:** ملاحظة تحليلية مستقبلية.

**نوعية المرضى وطرق الدراسة:** عشرون مريضا يعانون من ضيق القناة القطنية التنكسية وضعوا لعملية تخفيف الضغط علي الناحيتين من مدخل جراحي علي ناحية واحدة في مستشفيات جامعة عين شمس بين مايو 2014 وأبريل 2016. وقد تم تحليل مستقبلي لنتائجهم الإكلينيكية.

**النتائج:** في هذه الدراسة لعشرين مريض، كان اثني عشر من الذكور (60%) وثمانية من الإناث (40%). كان متوسط العمر  $43.1 \pm 12.33$  (مدى 35-55 سنة). تراوحت مدة الأعراض الإكلينيكية قبل الجراحة من 6 إلى 24 شهرا وكانت كالتالي: آلام أسفل الظهر (95%)، وعرق النسا (85%)، والعرج العصبي (100%) والتغيرات الحسية (80%). حدث قطع عرضي بألم الجافية في مريض واحد (5%) وكان في الأم الجافية الخلفية تحت الشريحة العظمية المقابلة قبالة خط الوسط. كان هناك تحسن ملحوظ في الألم بعد العملية الجراحية بعد إزالة الضغط عن الأعصاب بالقناة القطنية. كان هناك انخفاض ملحوظ في متوسط قيم الألم الكلي (آلام الظهر والساق) عند شهر  $(2 \pm 0.72)$  وثلاثة أشهر  $(1.85 \pm 0.58)$  وستة أشهر  $(1.6 \pm 0.68)$  بعد الجراحة عن متوسط قيم الألم قبل الجراحة  $(7 \pm 0.72)$  ( $P < 0.001$ )، وانخفض متوسط قيم «أوزويستري» للعجز بشكل ملحوظ عند شهر  $(27 \pm 9.78)$ ، ثلاثة أشهر  $(23 \pm 7.3)$  وستة أشهر  $(21 \pm 4.47)$  بعد الجراحة عنه قبل الجراحة  $(61 \pm 4.47)$  ( $P < 0.0001$ ).

**الاستنتاج:** تخفيف الضغط علي الناحيتين من مدخل جراحي من ناحية واحدة هو علاج فعال لحالات ضيق القناة القطنية.