



LATE RESULTS OF OPEN DOOR LAMINOPLASTY FOR CERVICAL OSSIFYING POSTERIOR LONGITUDINAL LIGAMENT

SERVİKAL LONGİTUDİNAL LİGAMAN OSSİFİKASYONU İÇİN AÇIK KAPI LAMİNOPLASTİNİN GEÇ SONUÇLARI

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SUMMARY:

Introduction: In this prospectively designed study, it was planned to present an Open Door Laminoplasty (ODL) series, to discuss effectiveness of this approach and to investigate correlation between preoperative cervical canal cross-sectional area and recovery rate of patients.

Patients and Method: A 47-patient group which had minimum 36 months follow-up was included in the study. All patients were performed a standard ODL. Preoperative and various postoperative times clinic and radiologic parameters were compared statistically, and recovery rates (RR) of patients were calculated.

Results: RR of patients was statistically significant by Friedman's test. It cannot be found any statistical relation between preoperative cross sectional area (CSA) and preoperative clinic by statistical significance tests. That RR decreases as preoperative symptom duration increases is remarkable.

Conclusions: ODL is an effective and safe way to reduce symptoms of degenerative cervical myelopathy due to OPLL.

Key words: Cervical spondylosis, Open door laminoplasty, Ossifying posterior longitudinal ligament, Surgical results

Level of evidence: Prospective clinical study, Level II

ÖZET:

Giriş: İleri dönük olarak planlanmış bu çalışmada, açık kapı laminoplasti (ODL) hasta dizisi sunularak, bu yaklaşımın etkinliği ve ameliyat öncesi kanal alanı ile hastaların belirti ve bulguları arasında ilişki olup olmadığının araştırılması amaçlanmıştır.

Hastalar ve yöntem: En az 36 ay takip edilmiş 47 hastalık bir topluluk çalışmaya alınmıştır. Tüm hastalara standart ODL yapılmıştır ODL. Ameliyat öncesi ve ameliyat sonrası çeşitli zamanlarda klinik ve radyolojik sonuçlar istatistiksel olarak karşılaştırılmışlardır. Hastaların iyileşme oranları hesaplanmıştır.

Sonuçlar: Hastaların iyileşme oranları Friedman testi ile istatistiksel olarak anlamlı bulundu. Ameliyat öncesi kanal alanı ile klinik arasında ilişki yoktu. Belirti ve bulgu süresi ile iyileşme oranı arasında ters ilişki olması dikkate değer bir durumdur.

Çıkarım: ODL, OPLL nedeni ile gelişen servikal dar kanalda belirti ve bulguların giderilmesi için etkin ve güvenli bir yaklaşımdır.

Anahtar kelimeler: Açık kapı laminoplasti, Cerrahi sonuçlar, Ossifiye posterior longitudinal ligaman, Servikal spondiloz

Kanıt düzeyi: Prospektif klinik çalışma, Düzey II

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INTRODUCTION

Long-lasting compression of the cervical spinal cord leads to a clinical syndrome of cervical spondylotic myelopathy (10,13). Posterior decompression for cervical spinal canal narrowing due to ossifying posterior longitudinal ligament (OPLL) is widely performed method although it cannot provide direct ossification excision (1). But by this approach, it can be avoided that many complications of an anterior approach such as spinal cord injury, hemorrhage or anterior dural tears (6,9). Besides, for cases with three or more vertebrae resections, implant failure and malunion risks will come into question (4). Comparable clinical outcome and less risk of complications of posterior approaches have made these approaches more popular. Open door laminoplasty (ODL) is a kind of posterior approaches which can preserve range of motion (14). ODL is performed widely since 1970s (8).

The primary goals of ODL are to decompress the spinal cord and maintain cervical spine stabilization. To minimize complications and provide long-term pain and disability control are the secondary aims of this approach. In this prospectively designed study, it was aimed to present an ODL series, to discuss efficacy of this approach and to investigate correlation between preoperative cervical canal cross-sectional area (CSA) and recovery rate (RR) of patients.

PATIENTS AND METHODS:

This study was conducted in Dışkapı Yıldırım Beyazıt Training and Research Hospital between July 2004 and August 2006. Study was started with 103 patients with cervical stenosis diagnosed by clinically and documented and approved by radiologically. A 47-patient group which had minimum 36 months' follow-up was included in the study. Two patients died because of amyotrophic lateral sclerosis (ALS) in a two-year period after operation and one patient have not come to hospital to control. So the study was conducted with 44 patients. Patients' ages were between 35 and 72 years with a mean of 56.61 ± 8.39 year. Thirty-two of patients were men and 12 of them were women (73 and 27 % respectively).

Including criteria: Men and women between 30 and 80 years old with cervical stenosis diagnosed by clinically and approved by radiologically; and patients followed-up minimum 36 months were included in the study. Each patient had minimum 2 levels of compression with accompanying signs and symptoms of myelopathy.

Excluding criteria: Patients with severe cardiac, metabolic, pulmonary or malignant diseases; patients had undergone spinal operations for any reason; patients had history of spinal trauma and patients with any accompanying spinal disorders such as spinal tumor, disc herniations, dislocations etc., were excluded from the study. Patient with ankylosing spondylitis and systemic infections were also excluded.

Preoperative work-up: A written informed consent was obtained from all patients. Clinic status of patients were assessed with mJOA scores preoperatively, postoperative 1. day, 3., 6., 12., 24., 36., 48., and 60. months. Preoperative radiological work-up included lateral, antero-posterior (AP) and oblique roentgenograms, cervical computed tomography (CT) and cervical magnetic resonance imaging (MRI). CSA was measured on axial MRI sections. For this measurement, the narrowest region was used.

Recovery rate (RR) was calculated due to the formula of $RR=100 \times (\text{postoperative mJOA}-\text{preoperative mJOA}) / 18-\text{preoperative mJOA}$ (3).

Operation: All patients were performed a standard ODL between C3 and C7 according to the description of Hirabayashi (5). Open side was decided due to patients' complaints. Autogenous bone grafts obtained from spinous processes of the cervical spine were used as expander in the open side of the laminoplasty.

Statistical analysis: Statistical package for the social sciences (SPSS) version 24.0 was used. Preoperative and follow-up RRs were compared by Friedman's test. Symptoms and RR correlations was investigated by Spierman's rho correlation test. CSA and preoperative clinical status was assessed by Pearson's correlation index.

Postoperative instructions: All patients discharged after a reasonable and uneventful period with a soft collar for using at least 3 weeks. Patients with neurologic complications were referred to physical therapy clinics to take under control and therapy.

RESULTS

Table-1 and 2 summarize mJOA scores and RR respectively (Table-1, 2).

Preoperative mean mJOA scores were 11.48 ± 2.79 (6-16). At all follow-up times, RR of patients were statistically significant by Friedman's test ($p<0.005$). It cannot be found any statistical relation between preoperative CSA and preoperative mJOA by statistical significance tests. The same situation is also true between postoperative CSAs and postoperative mJOA scores; and between RR and increasing CSA percent postoperatively ($p>0.05$). The narrowest CSA was 118.625 ± 45.88 mm² (56.50 ± 326.70 mm²) preoperatively. After operation, the narrowest CSA was 10.77 ± 2.62 mm² (7.4-18.0 mm²).

That RR decreases as preoperative symptom duration increases is remarkable ($r= -0346$ by Spierman's rho correlation test) (Figure-1).

Myelopathy symptoms were seen in 29 patients, where radiculopathy symptoms were found in 8 patients. Seven patients had both symptomatology of myelopathy and radiculopathy.

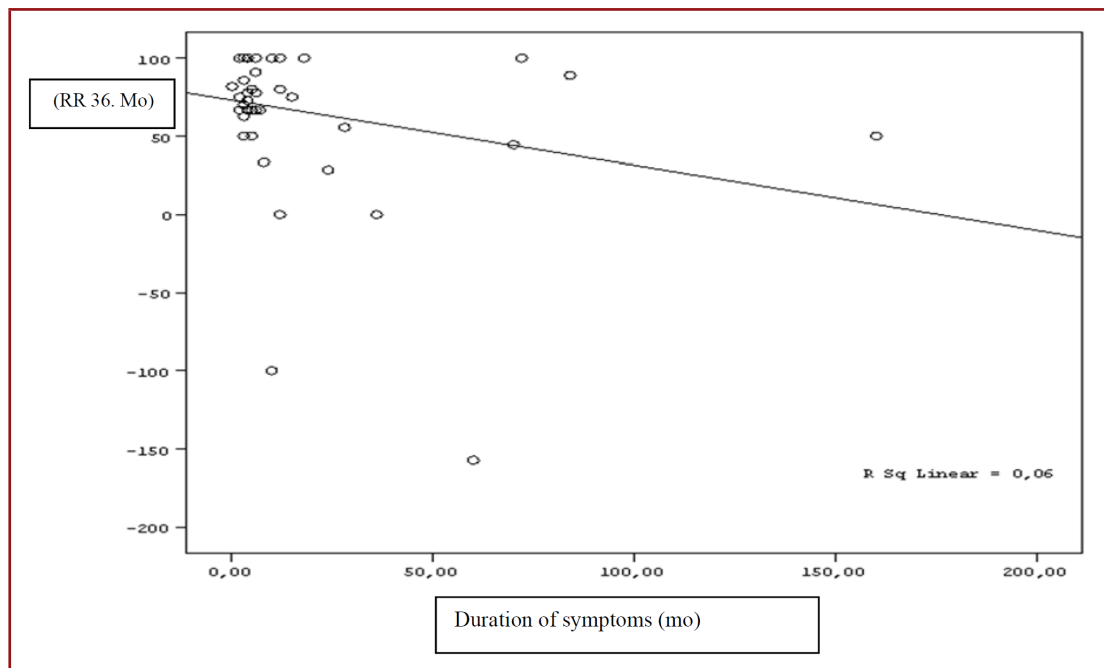


Figure-1. Relation of preoperative symptom duration and RR. 36. Month results were used for RR.

In 4 patients some surgical complications have developed (9.1 %). Shoulder drop due to C5 palsy was seen in 3 (6.8 %) and quadripareisis was seen in 1 (2.3 %) patient. Quadriparetic patient had undergone a second operation for widening decompression. After a rigorous physical therapy period, he has gained preoperative muscle strength.

Table-1. Preoperative and follow-up mJOA scores of patients.

| | preop | 1. day | 3. mo | 6. mo | 12. mo | 24. mo | 36. mo | 48. mo | 60. mo |
|---------|-------|--------|-------|-------|--------|--------|--------|--------|--------|
| N | 44 | 44 | 44 | 44 | 44 | 44 | 43 | 36 | 36 |
| Mean | 11,48 | 13,77 | 15,61 | 15,82 | 16,07 | 16,18 | 16,14 | 16,29 | 16,28 |
| Median | 11,00 | 14,00 | 16,00 | 16,00 | 17,00 | 17,00 | 17,00 | 17,00 | 17,00 |
| SD | 2,791 | 3,003 | 2,365 | 2,275 | 2,182 | 2,038 | 2,054 | 1,947 | 1,907 |
| Range | 10 | 15 | 9 | 8 | 8 | 8 | 8 | 8 | 8 |
| Minimum | 6 | 3 | 9 | 10 | 10 | 10 | 10 | 10 | 10 |
| Maximum | 16 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |

Table 2. Postoperative RR of patients.

| | Day 1 | 3. mo | 6. mo | 12. mo | 24. mo | 36. mo | 48. mo | 60. mo |
|---------|--------|--------|--------|--------|--------|--------|--------|---------|
| N | 44 | 44 | 44 | 44 | 44 | 44 | 36 | 36 |
| Mean | 32,61 | 62,85 | 65,66 | 69,36 | 71,66 | 66,05 | 68,75 | 72,9172 |
| Median | 43,65 | 69,05 | 77,78 | 80,91 | 80,00 | 77,78 | 81,67 | 78,8889 |
| SD | 60,014 | 46,463 | 46,165 | 41,738 | 37,392 | 50,555 | 40,644 | 37,7854 |
| Range | 333 | 200 | 200 | 200 | 200 | 257 | 150 | 200,00 |
| Minimum | -233 | -100 | -100 | -100 | -100 | -157 | -50 | -100,00 |
| Maximum | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100,00 |

Table 3. Pre and postop narrowest CSA of patients.

| The narrowest CSA | preop | postop |
|-------------------|-------|--------|
| N | 44 | 44 |
| Mean | 8,19 | 10,770 |
| Median | 8,00 | 10,000 |
| SD | 1,611 | 2,6216 |
| Range | 7 | 10,4 |
| Minimum | 5 | 7,6 |
| Maximum | 13 | 18,0 |

Table 4. Preoperative CSA of patients.

| | | |
|------------|----|----------|
| N | | 44 |
| Mean | | 118,6250 |
| Median | | 114,2700 |
| SD | | 45,88086 |
| Range | | 270,20 |
| Minimum | | 56,50 |
| Maximum | | 326,70 |
| Percentile | 25 | 85,3350 |
| | 50 | 114,2700 |
| | 75 | 142,4000 |

(Measurements are mm²)

DISCUSSION:

Degenerative narrowing of cervical spinal canal ordinarily happens in the natural course of aging ⁽²⁾. Symptomatic myelopathy develops as a result of this process. OPLL is an important factor that causes narrowing of the cervical spinal canal; and presence of OPLL may change operative procedure for decompressing spinal cord. Existence of OPLL, especially non-segmental types, partly reduces cervical mobility and by restraining the ROM ⁽¹¹⁾. Anterior cervical decompression and fusion (ADF) can provide complete ossification resection and decompression for cases with cervical myelopathy due to OPLL ⁽⁹⁾. But risk of spinal cord injury, dural tears, and extensive bleeding cannot be disregarded. Besides, an anterior decompression for OPLL sometimes requires vertebrectomy one or two levels. Enlarging the operation with vertebrectomy carries with some additional risks such as implant failure, malunion, screw malposition etc. ⁽⁴⁾. Although it cannot allow resection of OPLL, posterior decompression provides a wider canal for spinal cord. Thus, posterior decompression techniques become popular approaches by having far less risks. Laminectomy procedures previously have been performed

as decompression of the cervical canal from posterior sides for compressive myelopathy ⁽⁷⁾. But, extensive invasion of scar tissue after laminectomy worked as a new cause of compression. Furthermore, postoperative instability triggered additional complaints. Idea of “laminoplasty” developed in 1972 by a group of Japan investigators first time, for avoiding complications of laminectomy, and also providing benefits of posterior approach ⁽¹²⁾. Subsequently, many methods of cervical laminoplasty have been developed. “Open door” type laminoplasty techniques are constitutes one of two main types of laminoplasty due to the sites of osteotomy ⁽⁵⁾.

Results of this study, especially RR of patients at the postoperative period put forward effectiveness of ODL for treatment of cervical myelopathy due to OPLL. The main factor affecting positive postoperative result was duration of symptomatic period before operation. This negative correlation is one of the vital results of this study ($r = -0.346$). Another significant result of this study is that the preoperative CSA is not so central to produce symptoms preoperatively. And also, postoperative widening rate is not correlate with RR of patients ($p > 0.05$). This result might give rise to thought that effort for further widening the cervical canal by extension of laminoplasty beyond the standard borders or scale up the graft size has not provided more recovery at the same rate. However, extra widening the canal especially at the C5 root region may belong to avoiding C5 paresis. New, prospective clinical studies have needed to clarify this.

One limitation of this study is that the sample size was small. The other limitation is that comparing with other decompression techniques was a necessity for deciding effectiveness.

There is still debate about the proper surgical treatment of multilevel cervical degenerative disease involving three or more cervical segment. Although, an ADF is also a beneficial approach, ODL is an effective and safe way to reduce symptoms of degenerative cervical myelopathy due to OPLL.

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