

EFFICACY OF CAGE PLACEMENT WITHOUT PLATE IN PATIENTS WITH CERVICAL MYELOPATHY WITH SINGLE-LEVEL AFFECTION

EFICÁCIA DA COLOCAÇÃO DE CAGE SEM PLACA EM PACIENTES COM MIELOPATIA CERVICAL COM AFEÇÃO EM UM ÚNICO NÍVEL

EFICACIA DE LA COLOCACIÓN DE CAJA SIN PLACA EN PACIENTES CON MIELOPATÍA CERVICAL CON AFECCIÓN DE UN SOLO NIVEL

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ABSTRACT

Objective: To determine the efficacy of PEEK (Poly-ether-ether-ketone) cage without plate for the treatment of single-level cervical spondylosis. **Methods:** Ten patients with cervical myelopathy data, with a single-level root condition, seen at the outpatient clinic of the Neurosurgery Service, operated in 2016, mean age 53 years, 6 (60%) female, 4 (40%) obese, 3 (30%) smokers. The Cloward technique was used by anterior approach, discectomy, and PEEK cage placement. **Results:** At six months of surgery, 100% of the patients had increased intervertebral space, with a 100% reduction in osteophytes; only one patient had dysphagia, no patient had lesion of the adjacent segment and 10% had persistent root pathology. Cervical lordosis was observed in 90% of the patients and arthrodesis in 100% of the cases. **Conclusions:** Anterior approach arthrodesis using PEEK cage without cervical plate is effective as a treatment of cervical myelopathy in a single level.

Keywords: Cervical vertebrae; Arthrodesis; Cervical; Cervical spondylosis.

RESUMO

Objetivo: Determinar a eficácia da do uso de cage em PEEK (poli-éter-éter-cetona), sem placa para o tratamento de espondilose cervical em um único nível. **Métodos:** Dez pacientes com dados de mielopatia cervical com afecção radicular em um só nível, atendidos no ambulatório do Serviço de Neurocirurgia operados em 2016, com média de idade 53 anos, 6 (60%) do sexo feminino, 4 (40%) obesos, 3 (30%) tabagistas. A técnica de Cloward foi usada com acesso anterior, discectomia e colocação de cage em PEEK. **Resultados:** Aos seis meses de cirurgia, 100% dos pacientes tiveram aumento do espaço intervertebral, com redução de 100% de osteófitos; só um paciente teve disfagia, nenhum paciente teve lesão do segmento adjacente e 10% tiveram persistência da patologia radicular. Verificou-se lordose cervical em 90% dos pacientes e artrose em 100% dos casos. **Conclusões:** A artrose com acesso anterior usando-se cage em PEEK sem placa cervical é eficaz como tratamento de mielopatia cervical em um único nível.

Descritores: Vértebras cervicais; Artrose; Mielopatia; Espondilose cervical.

RESUMEN

Objetivo: Determinar la eficacia del uso de caja PEEK (poli-éter-éter-cetona) sin placa para el tratamiento de la espondilosis cervical con afección de un solo nivel. **Métodos:** Diez pacientes con datos de mielopatía cervical, con afección radicular a un solo nivel, vistos en la consulta externa del servicio de Neurocirugía, operados en el 2016, con edad promedio de 53 años, 6 (60%) del sexo femenino, 4 (40%) con obesidad, 3 (30%) con tabaquismo positivo. Se utilizó la técnica de Cloward con abordaje vía anterior, discectomía y colocación de caja de PEEK. **Resultados:** A seis meses de la cirugía, 100% de los pacientes tuvo aumento del espacio intervertebral, con la reducción del 100% de osteofitos, solo un paciente presentó disfagia, en ningún paciente hubo lesión de segmento adyacente y el 10% presentó persistencia de patología radicular. Hubo lordosis cervical en el 90% de los pacientes y artrosis en el 100% de los casos. **Conclusiones:** Es eficaz la artrosis por vía anterior usando caja PEEK sin necesidad del uso de placa cervical en el tratamiento de la mielopatía cervical con afección de un solo nivel.

Descriptores: Vértebras cervicales; Artrosis; Mielopatía; Espondilosis cervical.

INTRODUCTION

Degenerative cervical disc disease is a chronic disc lesion process initiated by microtrauma and followed by dehydration processes and biochemical changes causing rupture of the annulus, hernias, and height loss, with subsequent bone changes such as osteophytes that can cause narrowing of the canal with possible radicular or myelopathic compression of the neural elements.^{1,2}

Cervical pain has a lifetime prevalence of 66% and is usually associated with episodes of headache and low back pain.^{1,3,4}

Cervical myelopathy is a spinal cord dysfunction syndrome caused by the compression of the soft tissues and the bony structures in the cervical canal of congenital, degenerative, tumoral, or traumatic causes, which produces progressive neurological symptoms.^{1,5,6}

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It primarily affects men over 50 years of age and is the most common cause of paraparesis in adults and the lesion patterns have been divided according to the portion of the spinal cord affected into the transverse lesion syndrome, the motor system syndrome, the central system syndrome, the Brown-Séquard syndrome, and brachyalgia.²

Ferguson and Caplan divided myelopathy into medial, lateral, and combined syndromes, and vascular syndrome. The physical examination may reveal hyperreflexia below the compromised level, clonus, Babinski and Hoffman pathological reflexes, and abnormal gait. Motor and sensory changes are specific to the medullary level.^{1,5-12}

The natural history of cervical disc disease shows an average improvement of 75% with conservative treatment,⁸ while the natural history of cervical spondylotic myelopathy leads to gradual neurological degeneration, which is why surgical intervention should be performed as early as possible.^{1,6,9,10}

Treatment of disc disease of the cervical spine should begin with a conservative regimen that can include analgesics, NSAIDs, and opioids for pain control together with physical therapy for muscular control and traction for symptomatic control. Selective nerve blocks are also an option, however, cases with poor response to conservative orthopedic treatment may be candidates for surgical management.^{2,13-17}

Anterior approach cervical discectomy is a procedure for the decompression of the neurological elements that may increase or produce instability.¹³⁻¹⁸ C5-C6 discectomy significantly increases the mobility of the segment in flexion (66.6%), extension (69.5%), lateral inclination (41.3%), and axial rotation (37.9%).¹⁸

The goal of post-discectomy arthrodesis is to reestablish the spinal structure, recovering its rigidity and stability in order to avoid anomalous movements that produce or cause progression of the deformity or that produce or maintain secondary pain.¹⁷

In cervical myelopathy, arthrodesis eliminates the dynamic factor involved in its pathogenesis and favors the tension of the yellow ligaments that insert into the posterior surface of the spinal cord.^{18,19}

With the goal of standardizing the interbody fusion technique and eliminating the need for grafting, interbody cages of different materials were developed, both in cylindrical or parallelepipedal forms.¹⁹⁻²¹ Several biomechanical studies have demonstrated that the interbody cage behaves similarly to the tricortical iliac crest graft.²²⁻²⁴ These same in vitro studies also showed that the inclusion of an anterior cervical plate significantly increases stability and reduces the range of motion.¹⁸

The big problem with the cages is movement. To prevent anterior migration, it is recommended that the cage be placed 2mm behind the anterior edge of the vertebral body. To prevent posterior migration, the common posterior vertebral ligament, as well as a more or less wide portion of the posterior part of the disc, can be preserved. For this reason, the relatively anterior placement of the cages can be seen in post-operative imaging studies.²²⁻²⁷

PEEK (Polyether ether ketone) is a non-absorbable, semi-crystalline, polyaromatic linear polymer with qualities of strength, rigidity, durability, and resistance to the environment and with elasticity similar to bone. It is radiolucent and facilitates the observation of consolidation in simple radiographs,^{28,29} it is compatible with magnetic resonance, its inflammatory response is minimal, and its resistance to corrosion is excellent. However, it is harmful to growth cells and factors because the products of osteoclastic activity, alkaline phosphatase and fibroblasts, are increased following PEEK cage placement.²⁸

Complications from anterior cervical procedures may include intraoperative neurological (1% of cases), vascular (< 1%), esophageal (0.2-0.9%), and dural sac (< 1%) lesions. Early postoperative complications include recurrent lesion of the laryngeal nerve, which occurs in between 1 and 11% of cases, dysphagia, which is usually temporary, and severe respiratory distress (< 1%). There is a very low frequency of infection so it has little impact on the fusion rate. Failure of the material is also an early complication associated with the technique and with an increased number of fusion levels. Pseudoarthrosis is a later complication associated with failure of the material, tobacco use, and a larger number of fused levels, and is the main cause of cervical arthrodesis revision.³⁰

Therefore, the objective of this study is to determine the effectiveness of using the PEEK (polyether ether ketone) cage without a plate for the treatment of cervical spondylosis at a single level.

METHODS

This is a prospective, observational, longitudinal, open, non-randomized (case series) study with one year of follow-up. We identified 10 patients with cervical myelopathy with radicular involvement and no history of previous cervical surgery. They were seen in the outpatient clinic of the Neurosurgery Service and underwent anterior approach surgery during March and April 2016 using the Cloward technique for discectomy and PEEK cage placement.

We evaluated demographic variables such as sex, age, obesity, tobacco use, symptomatology and time of evolution, Visual Analog Scale for pain, Nurick scale, affected level, intervertebral space, presence of osteophytes, cage number, bleeding, surgical time, dysphagia, lesion of the adjacent level, persistence of sensory and motor radicular pain, hospitalization time, and follow-up conducted at 3, 6, and 12 months.

Statistical analysis consisted of conducting a descriptive evaluation estimating frequencies, percentages, and measures of central tendency and dispersion, using Excel and Epi Info v. 7.2 software.

Prior to the implementation of the protocol, it was evaluated by the Institutional Review Board for compliance with the international guidelines for conducting research projects (SIRELCIS R-2016-1301-183).

RESULTS

We analyzed 10 patients with cervical myelopathy with radicular involvement at one level, seen in the outpatient clinic of the Neurosurgery Service during the period from March to April of 2016, and who underwent anterior approach discectomy and PEEK cage placement using the Cloward technique. In terms of the study population demographics, the average age was 53 years, 6 (60%) patients were female and 4 (40%) were male, 4 (40%) were obese, and only 3 (30%) were tobacco users (Table 1).

In terms of the clinical profile data, half of the cases had experienced sensory symptoms for more than 12 months, 6 (60%) had a Visual Analog Scale for pain (VAS) score between 4 and 7 points indicating moderate pain, and 4 (40%) with a Nurick scale score of 1 (signs of spinal cord involvement, but without changes to gait), and the most frequently affected levels were C3-C4 and C5-C6, both with 50%. One hundred percent of the patients had reduced intervertebral space and 90% had osteophytes. Cage number 5 was the most often used, in 70% of the patients.

During surgery, 80% of the patients had bleeding of less than 100 cc. Surgical time was less than 2 hours in 80% of the patients and hospital stays were between 1 and 3 days in 80% of the patients (Table 2).

Twelve months after surgery, 100% of the patients had increased intervertebral space, with a 100% reduction of osteophytes. One patient had dysphagia, which resolved spontaneously within the first 3 months following surgery. None of the patients had any lesion of the adjacent segment and only 10% presented persistent radicular pathology. There was cervical lordosis in 90% of the patients and arthrodesis in 100% of the cases (Table 3).

During follow-up in the immediate postoperative period, at three months, and at 6 months, there was a decrease in the number of patients with a VAS score indicating intense or moderate pain, thus increasing the number of patients with mild pain to 60%.

As regards the Nurick scale, the number of patients rated Nurick 0 (Radicular signs and symptoms, without evidence of spinal cord involvement) increased to 50% (Figures 1 and 2).

Table 1. Distribution of the demographic data of the population.

Sex	Male	Female
	4 (40%)	6 (60%)
Obesity	Yes	No
	4 (40%)	6 (60%)
Smoking	Yes	No
	3 (30%)	7 (70%)

Table 2. Clinical profile behavior and trans-surgical findings.

Symptomatology	Motor	Sensory	Mixed			
	2 (20%)	5 (50%)	3 (30%)			
Duration	< 1 month	1-6 months	6-12 months	> 12 months		
	0 (0%)	1 (10%)	4 (40%)	5 (50%)		
VAS	Without pain	Mild pain	Moderate pain	Intense pain		
	0 (0%)	0 (0%)	6 (60%)	4 (40%)		
Nurick	0	1	2	3	4	5
	1 (10%)	4 (40%)	3 (30%)	1 (10%)	0 (0%)	1 (10%)
Level affected	C3-C4	C4-C5	C5-C6			
	5 (50%)	0 (0%)	5 (50%)			
Intervertebral space	Reduced					
	10 (100%)					
Osteophytes	Yes	No				
	9 (90%)	1 (10%)				
Cage number	4	5	6			
	2 (20%)	7 (70%)	1 (10%)			
Bleeding	< 100 cc	100-200 cc	> 200 cc			
	8 (80%)	2 (20%)	0 (0%)			
Surgical time	< 60 minutes	60-120 minutes	> 120 minutes			
	0 (0%)	8 (80%)	2 (20%)			
Hospital stay	1-3 days	4-6 days	> 7 days			
	8 (80%)	1 (10%)	1 (10%)			

Table 3. Postsurgical clinical results.

Intervertebral space	Increased
	10 (100%)
Osteophytes	No
	10 (100%)
Dysphagia	Yes
	1 (10%)
Lesion of the adjacent segment	No
	10 (100%)
Persistence of radicular pathology	No
	9 (90%)
Cervical lordosis	Yes
	9 (90%)
Arthrodesis	Yes
	10 (100%)

DISCUSSION

In the treatment of cervical myelopathy with involvement at a single level, anterior arthrodesis can be performed using a PEEK cage without the need for a cervical plate, as there was an increase of intervertebral space in 100% of the patients, with cervical lordosis in 90% and adequate arthrodesis in 100% of the patients, as well as

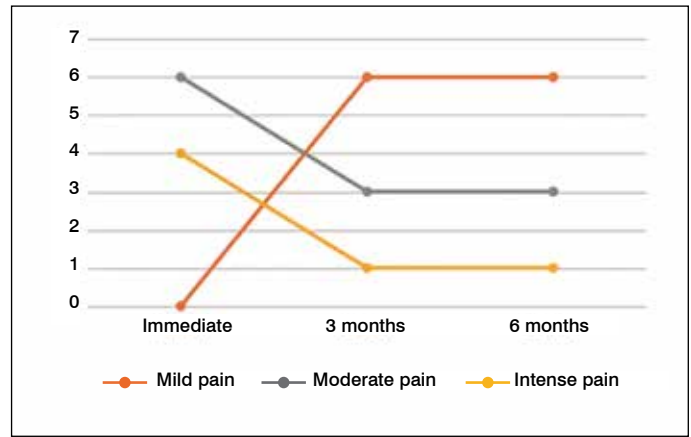


Figure 1. Postoperative behavior of the VAS.

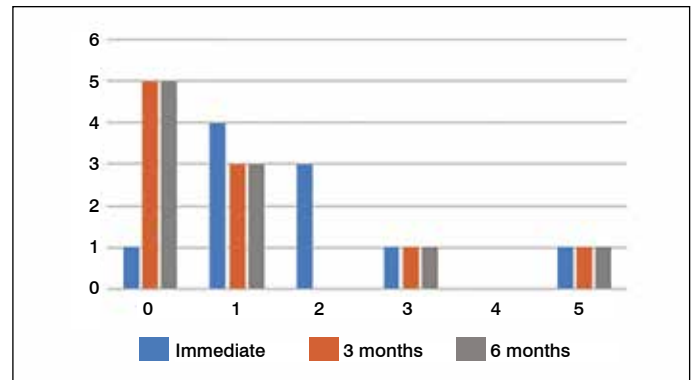


Figure 2. Postoperative behavior of the Nurick scale.

improvement of pain and the clinical profile, reducing the number of patients with moderate pain and increasing the number with mild pain in follow-ups at 3, 6, and 12 months. Similarly, there was clinical improvement, with an increase in the number of patients who moved from Nurick 1 or 2 to Nurick 0.^{7,8,10}

Our results are similar to those of previous studies, in the predominance of female patients, the similar average age, and the fact that most of the patients were not obese. When compared to the literature, our study met the goals for increased intervertebral space, cervical lordosis, and 100% arthrodesis.^{18,27}

The most affected level was C5-C6, a result similar to that reported in the literature, although in our study involvement of C3-C4 occurred with the same frequency. The surgical time was less than 2 hours, similar to that found in the articles reviewed. The average bleeding was 187 cc, slightly more than the less than 100 cc observed in 80% of the patients in our study.¹⁸

As for the evaluation of pain, intense-moderate pain had transitioned to mild pain at 6 months following surgery, similar to the results found in the literature.¹⁻³

We observed a reduction of the Nurick scale score of the patients, thus increasing the number of patients rated Nurick 0. Only one patient, classified as Nurick 5, did not improve. This result confirms the description of the advanced stages of cervical myelopathy, in which the treatment is focused on preventing progression and the deterioration of patients.^{7,8,10}

With respect to complications, only one patient presented dysphagia that resolved spontaneously, very similar as compared to the 20% of postoperative complications published in other articles. No patient required reintervention and there were no cases of CSF fistula or dysphonia from recurrent lesion of the pharyngeal nerve. Patient improvement was evaluated both clinically and by imaging, using the VAS and Nurick scales, which gave weight and value to the study.^{18,30}

CONCLUSION

Anterior approach arthrodesis using the PEEK cage without the need for a cervical plate is effective in the treatment of cervical myelopathy with involvement at one level, achieving an increase in intervertebral space, conservation of lordosis, and adequate fusion, with a reduction of pain as measured by the Visual Analog Scale and clinical improvement according to the Nurick scale. The procedure has low morbidity, minimal transoperative bleeding, a shorter surgical time, and an earlier discharge from the hospital.

The use of the cage without a plate for the treatment of cervical myelopathy with involvement at only one level is appropriate for establishing adequate fusion and clinical improvement in patients with a low risk of morbidity.

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