

POST-LAMINECTOMY DEFORMITIES

DEFORMIDADES PÓS-LAMINECTOMIA

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ABSTRACT

Objective: To present the deformities and evaluate the results of their treatment. **Methods:** Retrospective study of patients with deformity following surgical access to the spinal canal. Fifteen patients who met the inclusion criteria were included. Patients without complete data in medical records were excluded. **Results:** Fourteen patients underwent surgical treatment and one patient received conservative treatment with vest type TLSO. The average angle of kyphosis correction was 87° preoperatively to 38° postoperatively, while the associated scoliosis correction was 69° preoperatively to 23° postoperatively. **Conclusions:** The prevention of deformity should be emphasized to avoid laminectomy alone, while laminoplasty should be the procedure of choice for canal access in surgeries where there is no need for resection of the posterior elements.

Keywords: Kyphosis; Laminectomy; Paraplegia; Child, Congenital abnormalities; Arthrodesis.

RESUMO

Objetivos: Apresentar as deformidades e avaliar os resultados de seu tratamento. **Métodos:** Estudo retrospectivo de pacientes portadores de deformidade após cirurgia de acesso ao canal vertebral. Incluíram-se quinze pacientes que satisfaziam os critérios de inclusão. Foram excluídos os pacientes que não apresentavam dados completos no prontuário. **Resultados:** Quatorze pacientes foram submetidos a tratamento cirúrgico e um paciente ao tratamento conservador com colete do tipo OTLS. A correção angular média da cifose foi de 87° no pré-operatório para 38° após a cirurgia, enquanto a correção da escoliose associada foi de 69° no pré-operatório para 23° no pós-operatório. **Conclusões:** A prevenção da deformidade deve ser enfatizada evitando-se a laminectomia isolada, enquanto a laminoplastia deve ser o procedimento de escolha para acesso ao canal nas cirurgias em que não há necessidade de ressecção dos elementos posteriores.

Descritores: Cifose; Laminectomia; Paraplegia; Criança; Anormalidades congênitas; Artrodese.

RESUMEN

Objetivo: Presentar las deformidades y evaluar los resultados de su tratamiento. **Métodos:** Estudio retrospectivo de los pacientes con deformidad después del acceso quirúrgico al canal espinal. Quince pacientes que cumplían los criterios de inclusión fueron incluidos. Se excluyeron los pacientes que no tenían datos completos en la historia clínica. **Resultados:** Catorce pacientes fueron sometidos a tratamiento quirúrgico y un paciente recibió tratamiento conservador con ortesis OTLS. La corrección de la cifosis angular promedio fue de 87° antes de la operación a 38° después de la cirugía, mientras que la escoliosis asociada fue de 69° antes de la operación a 23° después de la operación. **Conclusiones:** La prevención de la deformidad debe ser destacada para evitar laminectomía solo, mientras que laminoplastia debe ser el procedimiento de elección para el acceso al canal durante la cirugía donde no hay necesidad de resección de los elementos posteriores.

Descriptores: Cifosis; Laminectomía; Paraplejía; Niño; Anomalías congénitas; Artrodosis.

INTRODUCTION

Spinal deformities following surgical procedures for access to the medullary canal, such as laminectomy or laminoplasty, occur in children submitted to this surgery.

Tachdjian and Matson¹ reported the appearance of spinal deformity in 26% of newborn infants and children who underwent laminectomy. Other authors have reported an incidence of 90-100%.²

Laminectomies are usually performed for the treatment of spinal cord tumors, neurofibromatosis and syringomyelia, among other intracanal pathologies.

According to Lonstein,³ it is proposed that following laminectomy, there is increased pressure on the cartilage endplates of the vertebral bodies in the anterior direction. Over time, cartilage growth is decreased and there is vertebral wedging, leading mainly to kyphosis, but with the potential to evolve into other spinal deformities.

If a post-laminectomy deformity develops, it may evolve into a serious and incapacitating deformity, threatening the spinal cord function. The relationship between neurological deficit and spinal deformities is complex. If a deficit occurs or deteriorates, it may be a result of spinal cord compression at the level of the deformity, or of the recurrence of a tumor.⁴

The treatment of post-laminectomy deformities is essentially surgical, provided above-normal values are present and the deformity proves to be progressive.

The type of surgical treatment used is closely related to the biomechanical and pathomorphological characteristics of the deformity, and also to the presence of compression of the nerve structures.

The goal of this study is to present our strategy and the results of the surgical and conservative treatment of deformities following surgical access to the spinal canal in children.

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MATERIALS AND METHODS

A retrospective study based on a review of the medical records of patients treated by the Orthopedics Service of Hospital Pequeno Príncipe, in Curitiba, Paraná, Brazil, for deformity following surgical access to the spinal canal, between 2000 and 2012. The study was approved by the Research Ethics Committee of the abovementioned hospital.

Fifteen treated patients were found in this period. The inclusion criterion used was the period described above and the diagnosis of deformity following surgical access to the spinal canal. The exclusion criterion used was medical records with incomplete data. All fifteen patients were included in the study.

Fourteen of these patients were treated surgically and one was treated conservatively with the use of a TLSO type vest.

Ten patients were submitted to laminectomy, and four other patients to laminoplasty. (Table 1)

Thirteen patients underwent surgical access to the canal due to malignant tumors.

In relation to the underlying disease, five patients had a diagnosis of neuroblastoma, four a diagnosis of astrocytoma, one a diagnosis of teratoma, one a diagnosis of PNET, one had a diastematomyelia correction and three a diagnosis of glioma.

The average age at laminectomy/laminoplasty was three years and one month.

Five patients presented with neurological deficit prior to the treatment of the acquired deformity, which ranged from clonus to paraplegia. (Table 2)

The average age at the time of surgery for correction of the deformity was eleven years and seven months.

Three patients were treated with double access, with combined anterior and posterior fusion. Eleven patients underwent surgery via the posterior route only. Anterior instrumentation was not used in any of the cases. Posterior instrumentation was used in the fourteen cases treated surgically.

Table 1. Diagnosis.

Diagnosis	Patients
Neuroblastoma	5
Astrocytoma	4
Glioma	3
PNET	1
Teratoma	1
Diastematomyelia	1
Total	15

Table 2. Deformity and neurological deficit.

Patient	Deformity	Neurological deficit
1	Kyphosis	Force M4 L3 right
2	Lordoscoliosis	No
3	Scoliosis	No
4	Kyphosis	Force M4 LL
5	Kyphosis	Paraplegia
6	Kyphoscoliosis	Paresthesia in both LL
7	Kyphoscoliosis	No
8	Lordoscoliosis	No
9	Kyphosis	No
10	Kyphoscoliosis	No
11	Kyphoscoliosis	No
12	Kyphoscoliosis	Clonus LL
13	Kyphosis	No
14	Kyphoscoliosis	No
15	Kyphosis	No

The mean follow-up period was three years and eight months (ranging from eight months to eleven years and three months) after surgical correction.

The magnitudes of the curves were measured using the Cobb method and the mean values are presented with standard deviation. The statistical analyses were performed using the Student's t-test. Statistical significance was established at the level of $p < 0.05$.

RESULTS

In general, the spinal deformities were detected within four years and three months after laminectomy/laminoplasty.

Ten patients were submitted to laminectomy and four to laminoplasty, totaling fourteen patients treated surgically.

Of the twelve patients treated surgically with kyphosis, the magnitude decreased from 87° (SD 23.4°) to 38° (SD 21.1°) ($p=0.00$) after surgery.

In the deformities in which there was associated scoliosis, the preoperative mean value was 69° (SD 19.4°), which decreased to 23° (SD 20.2°) ($p=0.00$).

The patient treated conservatively is still in follow-up and their scoliosis is currently at 18° of T3-T10 and 26° of T10-L4, having already reached skeletal maturity.

Of the fourteen patients treated surgically, five presented with neurological deficit prior to the correction of the deformity. Following the surgery for correction, two achieved complete resolution of the neurological symptoms and the others did not result in deterioration. The only patient treated conservatively did not present any changes in their neurological status throughout the follow-up period. (Table 2)

DISCUSSION

Post-laminectomy deformity is the clinical and radiographic expression of the loss of resistance of the posterior elements to traction forces, associated or not with failure of capacity to support the anterior portion of the spinal column, resulting in progressive deformity, sometimes accompanied by neurological deficit due to compression of the nerve tissues inside the spinal canal.

According to Robert and Bortolussi,⁴ as the kyphosis progresses, the weight bearing axis of the body is anteriorly displaced, increasing the tendency towards kyphosis progression and forming a vicious circle that can only be interrupted with the restoration of the sagittal balance of the spine.

An understanding of the concept of sagittal balance of the spine and of the biomechanical aspects present in this type of deformity is crucial in the elaboration of its treatment. This treatment should take into account factors such as magnitude and speed of progression, as well as neurological alterations.

Post-laminectomy deformities appear relatively early (in this series, four years and three months after laminectomy), but patients should be followed up until the end of adolescence, as deformities can arise and/or deteriorate rapidly during puberty.

Postoperative immobilization does not prevent the appearance of the deformity but can delay it. According to Dubousset et al.,² all children should be treated with post-laminectomy immobilization.

Laminoplasty can also be a solution if there is no need for complete resection of the posterior elements (e.g. in a tumor that does not affect them), but a necessary condition for success is postoperative immobilization, as mentioned by Papagelopoulos et al.⁵

In the vast majority of cases, the patient needs surgical treatment. According to Stagnara,⁶ there are indications for the production of a preoperative distraction plaster cast, and it would help to correct the deformity, increase pulmonary capacity and allow better surgical correction, yet in this series it was not used on any patient.

Of the patients with neurological damage before the correction, if the installation is acute there is a better chance of recovery when the canal is decompressed. Nevertheless, in those where the neurological deficit is chronic, the chances of improvement are drastically reduced.⁷ In the series, of the five patients with pre-correction neuro-

logical deficit, two achieved complete resolution of the injury and the other three did not experience worsening of the neurological status.

Although there is plenty of data in the literature addressing iatrogenic deformities of the spine, most of this data is restricted to the cervical column.

In the study by Otsuka et al.,⁸ 12 patients were treated surgically, and mean kyphosis was corrected from 84° to 35°, similar to our series.

The development of new fixation systems has enabled a more premature and effective approach to the deformity, with improvement of the correction potential.

The approach via a single posterior route has been the route of choice, but as there is extensive variability of clinical presentations, there is no standardization for the treatment.⁹

It is known that the anterior route increases the rate of consolidation, besides reducing correction loss, but the percentage of complications decreases when the surgeon decides not to perform thoracotomy.

Having undergone laminectomy/laminoplasty, children should be

carefully observed, as the odds of developing spinal deformities are high.

Orthopedic treatment is indicated as soon as the deformity arises. The aim of nonsurgical treatment is to delay the progression of the deformity and thereby postpone the arthrodesis until acceptable spinal and pulmonary development.

Both the posterior route and the combined route constitute a viable option for treatment, and their choice will depend on the "personality" of the deformity.

CONCLUSION

The prevention of the deformity is vitally important. Isolated laminectomy should be avoided whenever possible, while laminoplasty should be the procedure of choice to explore the spinal canal.

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