

DECOMPRESSION AND VERTEBRAL INSTRUMENTATION IN LUMBAR STENOSIS: LEVEL RELATED EARLY COMPLICATIONS AFTER SURGERY

DESCOMPRESSÃO E INSTRUMENTAÇÃO NA ESTENOSE LOMBAR: RELAÇÃO ENTRE OS NÍVEIS OPERADOS E AS COMPLICAÇÕES INTRA E PÓS-OPERATÓRIAS IMEDIATAS

DESCOMPRESIÓN E INSTRUMENTACIÓN EN ESTENOSIS LUMBAR: RELACIÓN ENTRE LOS NIVELES OPERADOS Y LAS COMPLICACIONES INTRA Y POSTOPERATORIO INMEDIATAS

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ABSTRACT

Objective: Lumbar surgery with transpedicular instrumentation allows adequate fusion to stabilize the affected vertebral segments and favors arthrodesis. Most of cases required complex and prolonged procedures in elderly patients with multiple comorbidities. The extent of levels submitted to decompression and fusion is not always consensual. The authors intend to determine whether a relationship exists between the operated levels and the complication rate intra- and postoperatively. **Methods:** This is a retrospective study including 50 subjects with lumbar stenosis submitted to surgery between 2009 and 2010. The mean age of the group was 65.98±8.82 years old. The number of instrumented levels (IL) and decompressed levels (DL) was determined. Variables included were: time in postanesthesia care unit (PACU); blood transfusions (BT); hemoglobin loss (Hgb); surgery time in minutes; days of hospitalization; and ASA score (American Society of Anesthesiologists). Neurologic complications, infectious, vascular complications, incorrect screw placement and re-operated patients were also assessed. Two groups: Group A (IL ≤3) and Group B (IL >3). Statistical analysis with SPSS19®. **Results:** Increased IL and DL related with increased need of BT, longer time in PACU; greater loss of Hgb and increased surgical time (p<0,05). DL and IL associated with more complications (p<0,05). Group A vs Group B: Group B – increased need of BT (p<0,05); longer PACU time (p<0,05); greater Hgb loss (p<0,05); longer surgical time (p<0,05); higher complication rate (p<0,05). **Conclusion:** This overall rate of complications should be used to better inform patients about surgery risks and in surgery planning, particularly in older patients with comorbidities. Care must be taken when performing three levels of fusion/decompression or more.

Keywords: Spinal stenosis; Intraoperative complications; Postoperative complications; Spinal fusion; Spine/surgery.

RESUMO

Objetivo: Na cirurgia lombar, a instrumentação pedicular proporciona a estabilização dos segmentos afectados e favorece a artrodesis. Trata-se na maioria das vezes de procedimentos complexos em pacientes idosos e com várias co-morbilidades. O número de níveis a descomprimir/artrodesar nem sempre é consensual. Os autores pretendem determinar se existe relação entre o número de níveis operados e as complicações intra e pós-operatórias. **Métodos:** Estudo retrospectivo que incluiu 50 indivíduos com estenose lombar submetidos a descompressão e fixação vertebral posterior entre 2009 e 2010. Idade média 65,98±8,82 anos. Contabilização dos níveis instrumentados (NI) e níveis descomprimidos (ND). **Variáveis averiguadas:** Tempo de recobro em unidade pós-anestésica/intensivos (UPA); Unidades de glóbulos rubros transfundidos (GR); Variação da concentração de Hemoglobina (Hgb); Tempo cirúrgico (minutos); dias de internamento; ASA score (American Society of Anesthesiologists). **Contabilização das complicações neurológicas, infecciosas, vasculares, Mau posicionamento parafusos e doentes reoperados. Divisão em dois grupos: Grupo A: ≤3 NI e Grupo B: >3 NI. Estudo estatístico em SPSS®. Resultados:** Relação entre NI e ND com mais GR, mais tempo UPA, maior perda Hgb e maior tempo cirúrgico (p<0,05). Relação entre NI e ND com maior número de complicações (p<0,05). Instrumentações/descompressões >3 níveis associadas a maior necessidade de transfusão (p<0,05), mais tempo na UPA (p<0,05), maior perda hemática (p<0,05), maior tempo cirúrgico (p<0,05) e maior incidência de complicações (p<0,05). **Conclusão:** Na estenose lombar, instrumentações/descompressões acima de três níveis têm taxa de complicações mais elevada, assim, no planeamento pré-operatório a relação risco/benefício deve ser ponderada particularmente nos pacientes mais idosos e com mais co-morbilidades.

Descritores: Estenose espinal; Complicações intraoperatórias; Complicações pós-operatórias; Fusão vertebral; Coluna vertebral/cirurgia.

RESUMEN

Objetivo: En la cirugía lumbar, la instrumentación pedicular proporciona la estabilización de los segmentos afectados y favorece la artrodesis. En la mayoría de las veces, se trata de procedimientos complejos en pacientes ancianos y que tienen varias comorbilidades. El número de niveles a descomprimir/artrodesar no siempre es consensual. Los autores tuvieron la finalidad de determinar si existe relación entre la cantidad de niveles operados y las complicaciones intra y posoperatorias. **Métodos:** Estudio retrospectivo que incluyó a 50 individuos con estenosis lumbar sometidos a descompresión y fijación vertebral posterior, entre 2009 y 2010. Edad promedio de 65,98 ± 8,82 años. Registro de los niveles instrumentados (NI) y de los niveles descomprimidos (ND). **Variáveis analizadas:** Tiempo de recuperación en unidad posanestésica/intensiva (UPA); Unidades de glóbulos rojos transfundidos (GR); Variación de la concentración de Hemoglobina (Hgb);

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Tiempo quirúrgico (minutos); Días de internación; ASA score (American Society of Anesthesiologists). Se registraron las complicaciones neurológicas, infecciosas, vasculares, mal posicionamiento de tornillos y enfermos operados de nuevo. División en dos grupos: Grupo A: ≤ 3 NI y Grupo B: > 3 NI. Estudio estadístico en SPSS®. Resultados: Relación entre NI y ND con más GR, más tiempo de UPA, más pérdida de Hgb y menos tiempo quirúrgico ($p < 0,05$). Relación entre NI y ND con mayor número de complicaciones ($p < 0,05$). Instrumentaciones/descompresiones > 3 niveles asociados a más necesidad de transfusión ($p < 0,05$), más tiempo en la UPA ($p < 0,05$), más pérdida hemática ($p < 0,05$), más tiempo quirúrgico ($p < 0,05$) y más incidencias de complicaciones ($p < 0,05$). Conclusión: En la estenosis lumbar, instrumentaciones/descompresiones, en más de tres niveles, tienen tasa más alta de complicaciones, por consiguiente, en el planeamiento preoperatorio, la relación riesgo/beneficio debe ser ponderada, especialmente para los pacientes más ancianos y con más comorbilidades.

Descriptores: Estenosis espinal; Complicaciones intraoperatorias; Complicaciones posoperatorias; Fusión vertebral; Columna vertebral/cirugía.

INTRODUCTION

The growing technological advancement and updating of diagnostic tools, surgical techniques, and specifically vertebral implant materials have broadened indications and turned lumbar surgery into a standard procedure for the treatment of conditions affecting the lumbar spine.¹ This becomes particularly important in inclusion of increasingly older patients, since in this age group the prevalence of chronic back pain grows exponentially with aging.²

One of the most common disorders in the elderly population is lumbar stenosis,³ which constitutes one of the most common indications for surgery in this age group.^{4,5} Symptomatic lumbar stenosis results from progressive degenerative changes at the level of the intervertebral joints and the adjacent ligaments, leading to stenosis of the lumbar canal and foramina.⁴ The clinical manifestations of this disease severely limit patients, especially in terms of mobility with a consequent impairment of the quality of life.

Conservative treatment of lumbar stenosis has shown limited benefit and provides poor results in the medium and long term,⁶ a fact that has promoted surgery as standard treatment.² These procedures may be more or less invasive and if, on one hand, the benefits of surgery have been recognized in successful cases, it is also true that the complications inherent in it may decrease the likelihood of good results, as well as cause damage or ultimately lead to death.⁷

Thus, it is of interest to the surgeon and the patient to know the various complications associated with the early postoperative period and investigate the possible risk factors. Age has been widely discussed in the literature and, although it may affect the medical decision, consensus has not been reached on the possibility of constituting an independent risk factor.²

In this context, it makes sense to question the type and extent of surgical procedure for elderly patients with multiple comorbidities. A more invasive/extensive approach might mean a longer operative time, more blood loss and an exponentially increased risk of complications. The objectives of this study are: 1) to determine the prevalence of complications associated with the surgical treatment of lumbar stenosis, 2) to determine the relationship between the extent of decompression and/or instrumentation and the risk of complications, and 3) to assess whether age is an isolated risk factor for surgery.

MATERIAL AND METHODS

Retrospective cohort: Evaluation of patients with lumbar stenosis who underwent decompression and posterior spinal fixation between 2009 and 2010.

We included 50 individuals with the following criteria: 1) uni- or multilevel lumbar stenosis, 2) surgical treatment with posterior decompression and fixation with transpedicular screws, 3) symptom duration of more than 12 months. Patients with associated pathology such as trauma, infection, or tumor were excluded.

Of the 50 individuals, 21 were male. The average age was 66 years, with a range between 50 and 85 years. All patients had clinical evidence of neurogenic claudication associated with low back pain preoperatively and the diagnosis was confirmed by nuclear magnetic resonance.

All patients were operated on by surgeons of the Spine Group of the Department of Orthopedics, Centro Hospitalar S. João.

Decompression consisted of unilateral or bilateral laminectomy with foraminectomy associated with one or more levels, and of posterolateral arthrodesis with transpedicular screws and rods with the placement of autologous bone graft *in situ*. Intervertebral discs were not approached nor was intersomatic arthrodesis performed in any patient included in the study.

The decompressed levels ranged from 1 (minimum) to 5 (maximum), while the instrumentation levels ranged from 2 (minimum) to 10 instrumented levels. Intervertebral levels are considered in the levels that were instrumented and decompressed. The larger number of instrumented levels is explained by the need to correct/fix degenerative scoliosis deformities in some patients with instrumentation widened to the thoracic and sacral levels (S1).

Variables measured: various surgical parameters were recorded for each patient that were considered to be factors of greatest aggression/surgical invasion: 1) recovery time in a postanesthesia care unit (PACU); 2) surgery time (minutes); 3) blood transfusions (GR); 4) change in hemoglobin (Hgb); 5) days of hospitalization; 6) ASA score.

The parameters involved in the recovery time, surgery time, and ASA score were measured by the Picis Anesthesia Manager® computer program. Information regarding the number of blood transfusions was provided by the blood clinic of the hospital and confirmed by Picis Anesthesia Manager®, if performed during surgery or in recovery, and also by the daily clinical patient diaries.

All patients undergoing surgery for lumbar decompression routinely control hemoglobin variation with a blood count on the first postoperative day. The variation of hemoglobin was calculated from the values on the first postoperative day and preoperative values.

The complications considered for this study were: 1) lesions of the dura, 2) CSF fistulas, 3) surgical wound infections, 4) reoperations, and 5) major complications. All these parameters were evaluated by consulting the patient's medical file, including the surgical report and clinical journals.

Clinical study

Overall results were initially evaluated after surgery with the accounting of the various complications and surgical parameters described. The occurrence of complications was determined from the analysis of these data and the operative variables were registered for each patient after surgical treatment of lumbar stenosis.

Patients were divided into two groups according to the number of instrumented levels: Group A with instrumentation at ≤ 3 levels and Group B with instrumentations at > 3 levels. This choice of interval was made after the homogenization of the sample and after verification that the differences were statistically significant for these values. Variables were compared between the two groups.

Statistical study

Statistical analysis was performed with SPSS 19® software. Descriptive and epidemiological analyses were performed on the study sample, as well as statistical analysis of the results obtained with a significance level of 0.05.

The Mann-Whitney U-test was used to compare the two groups for various surgical parameters as well as the occurrence of complications. Several statistical correlations (Pearson's coefficient) between age, surgical parameters, instrumented levels, and decompressed levels were performed with the occurrence of complications.

RESULTS

Of the 50 patients, 30 were included in group A and 20 in group B. Demographic data were summarized in Table 1.

General complications: Complications of total sample and the perioperative parameters under consideration are summarized in Table 2. Blood transfusion was required in 48% of patients. The change in hemoglobin between pre- and post-operation showed an average loss of 3.59 g/dL. Eighty percent of patients had an ASA score of two, 10% had an ASA of one and the other 10% had an ASA of three.

In total there were complications in 11 patients (22% of total), two had major complications (one patient had acute coronary syndrome and one had lower limb ischemia), which coincided with the patients who had laceration of the dura intraoperatively. There were seven lacerations of the dura (including the two mentioned above) and one CSF fistula. One patient required reoperation for screw malposition and two patients had superficial surgical wound infection that resolved with antibiotic treatment and dressings.

The systematic comparison of results between the two groups is found in Tables 3 and 4. Statistically significant results show a greater need for blood transfusion in patients undergoing instrumentation for more than three levels. Similarly, these patients stayed in recovery longer and required longer operative times. The change in hemoglobin was also statistically different for the two groups, given that group B patients lost an average of 4.16 g/dL. The days of hospitalization and the ASA score were not different between the two groups.

From the analysis of the complications, group A showed a total of four while group B had nine complications total, and this difference was statistically significant. The major complications were observed in the group with instrumentation for more than three levels (Group B) as well as surgical wound infections.

Statistical correlations performed using Pearson's coefficient showed a positive relationship between the number of levels decompressed and instrumented and an increased need for transfusions, greater hemoglobin loss, longer surgical time, and a higher complication rate ($p < 0.05$). The greater the number of instrumented levels, the longer the recovery time in the PACU. Age and the need for blood transfusion were positively correlated, i.e., the higher the age, the greater the need for transfusion. Increasing age did not increase the occurrence of complications and, similarly, the surgical time and loss of hemoglobin was not associated with an increased risk of complications. (Table 5)

Table 1. Demographics.

Variable	Group		Total
	Group A (n=30)	Group B (n=20)	50 patients
Sex (M:F)	12:18	9:11	21:29
Mean age	64.5 ±8.74	68.2 ±8.69	65.9 ±8.82
Instrumented levels	≤3	>3	2 a 10

Table 2. Total complications and variables measured.

	Total	Total
Dura lacerations	7 (14%)	Transfusions 48%
CSF fistula	1 (2%)	PACU recovery 1 to 9 hours
Superficial wound infection	2 (4%)	Hgb change -3.59 g/dL
Reoperation	1 (2%)	Surgical time (mean) 209 min
Major complications	2 (4%)	Hospitalization days 10.5 days
Acute coronary syndrome	1	ASA ASA 1 (10%) ASA 2 (80%) ASA 3 (10%)
Lower limb ischemia	1	

Table 3. Comparison of surgical stress parameters between group A and B.

	Group A	Group B	p*
Transfusions	33%	70%	< 0.001
PACU recovery	1 to 4 hours	3 to 9 hours	< 0.05
Hgb change	-3.20 g/dL	-4.16 g/dL	< 0.05
Surgical time (mean)	188 min	241 min	< 0.001
Hospitalization days	9.5 days	11.9 days	ns
ASA	ASA 1 – 5	ASA 1 – 0	ns
	ASA 2 – 22	ASA 2 – 18	
	ASA 3 – 3	ASA 3 – 2	

*differences calculated by the Mann-Whitney U-test.

Table 4. Comparison of surgical complications between group A and group B.

	Group A	Group B	p*
Dura lacerations	2	5	
CSF fistula	1	0	
Superficial wound infection	0	2	
Reoperation	1	0	
Major complications	0	2	
Total	4	9	<0.05

*differences calculated by the Mann-Whitney U-test.

Table 5. Pearson's correlations.

	Complications	Transfusion GR	Time in PACU	Hgb loss	Surgical time	Days of hospitalization
Age	ns	0.84*	ns	ns	ns	ns
Instrumented levels	0.79*	0.89*	0.87*	0.76*	0.78*	ns
Decompressed levels	0.80*	0.90*	ns	0.87*	0.82*	ns
Surg. time	ns					
PACU time	ns					
Hgb loss	ns					

* $p < 0.05$.

DISCUSSION

The purpose of this study was to determine the rate of complications associated with the surgical procedure in the treatment of lumbar stenosis in our clinic, determine whether there is a relationship between the extension of the approach and the occurrence of complications, and to determine if age was an isolated risk factor for a higher complication rate.

The limitations associated with this study include those based on its retrospective design. A sample of 50 patients may be considered small in order to determine the rate of procedural complications, and the study comprises only one surgical clinic and is therefore not representative of Portugal.

In the present study, there were 13 complications in 11 patients (22%). The most frequent complication was laceration of the dura mater (seven cases), followed by superficial infections, and major, life threatening complications. It becomes difficult to draw a parallel with other studies published in the literature, because there are actually significant differences in the criteria for the definition and inclusion of complications.⁸ Furthermore, the heterogeneity of the studies is evident when examining the pathologies included as well as the surgical procedures encompassed. Sobottke et al.² indicate that the rate of complications in several published studies varies between 2.5 and 80%, with most complications being minor, which do not prolong hospitalization.^{9,10} Schoenfeld et al.¹ mention a complication rate of 7.6% in a sample comprised of 3475 patients, but emphasized the inclusion of patients with diverse degenerative diseases such as the disc herniation that was not subject to decompression procedures or instrumentation.

The extension of the procedure is a factor that can influence

the rate of complications. In this study, approaches involving more than three levels were associated with a higher rate of complications, with greater loss of hemoglobin and increased surgical time, which in the context of elderly patients and various comorbidities can or should influence operative planning. Carreon et al.¹¹ refer to a 2.4 times greater risk for each segment addressed and, moreover, Cassinelli et al.¹² demonstrated that the risk of major complications is significantly associated with the approaches involving more than four levels. However, no consensus exists regarding the influence of the extent of surgery on the risk of complications; in their review of 1764 patients, Sobottke et al.² showed no significant differences in the rate of complications depending on the number of levels operated. Likewise, in a study of 20 patients aged over 80 years, Raffo et al.¹³ did not reveal an increased risk of complications, but emphasized the fact that only 75% of patients in their study underwent instrumentation and the complications included were only those that were considered life threatening.

In a somewhat predictable manner, this study demonstrated that more extensive approaches have a statistically significant greater loss of hemoglobin (and also a greater need for transfusion), longer surgical time, and longer recovery period. The premise that this increased stress increases the risk of surgical complications was not proven, as demonstrated by the Pearson's correlations performed.

In a retrospective study of 118 patients with lumbar stenosis, Ragab et al.¹⁴ reported complications in 20% of patients. As in this study, greater loss of blood and increased age did not correlate with increased morbidity or mortality. Once again, age does not reach consensus in the literature regarding its influence on the occurrence of complications. Several studies have shown a direct relationship between increasing age and the rate of early complications,^{1,2,11,15} while others have not validated the same hypothesis.^{13,16} It should

be noted that the latest and multicentric reviews have clearly shown the direct relationship between age and the risk of complications. The retrospective design of this study, as that of Ragab et al.¹³ and Silvers et al.¹⁵ associated with relatively small sample sizes, can influence the results and the lack of relationship between age and complications after lumbar surgery.

In the context of degenerative spinal surgery and the risk population covered, it makes sense to determine the complications associated with surgical treatment. Hence, many published studies have been dedicated to the subject in order to answer the concerns of the surgeon and the patient; however, there is still a need for homogenizing these studies in relation to specific diseases and treatments, so as to avoid deducing or transposing results to a specific group of patients.

CONCLUSION

In this study, we describe the most common complications associated with a procedure for decompression and lumbar fusion. The rate of complications, according to the criteria defined in this study, was 22%. Furthermore, instrumentations involving more than three levels were associated with an increased likelihood of complications.

If a more extensive approach with more levels being operated means an increased risk of complications, the surgical option in older patients with more comorbidities should be considered in light of the benefit-risk assessment for the patient.

All authors declare no potential conflict of interest concerning this article.

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