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ORIGINAL STUDY

Unilateral laminotomy with bilateral decompression for lumbar spinal stenosis : short-term risks in elderly individuals

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The aim of this retrospective study was to compare the short-term (4 weeks) surgical complications after unilateral laminotomy for bilateral decompression (ULBD) in patients with lumbar spinal stenosis, below and above age 65. Twenty-nine consecutive patients operated upon in 2011 were included : 12 below age 65, and 17 above age 65. Five complications (17.1%) were observed, all in the older age group : 3 dural tears, one root injury, and one subcutaneous collection requiring re-operation. The difference between groups was not statistically significant (p = 0.0521). Moreover, comparable or higher complication rates were noted after alternative techniques. The CRP level, obtained one day postoperatively, was lower than after alternative procedures, pleading for the limited invasiveness of ULBD. Old age seems to be associated with slightly elevated rates of short-term surgical complications, but without an increment in morbidity. Unilateral laminotomy for bilateral decompression does not carry an excessive risk in the elderly population.

Keywords : lumbar spinal stenosis ; unilateral laminotomy for bilateral decompression ; undercutting technique ; complications ; elderly.

INTRODUCTION

Lumbar spinal stenosis is characterized by a decreased diameter of the spinal canal, leading to compression of the neural structures. This is mostly due to degenerative changes, although other mechanisms are also described, including trauma, infection, congenital malformations and surgery. Degenerative lumbar spinal stenosis (DLSS) originates from hypertrophy of the ligamentum flavum and facet joints and from loss of vertebral disc height (*9*). Compression of the neural elements can lead to neurogenic claudication and radiculopathy. DLSS is becoming increasingly prevalent (*7*), as the population grows older. Greater technical possibilities and increased expectations regarding physical function at older age have led to an increase in surgical treatment for LSS in the elderly. It is currently the most common indication for spinal surgery, and responsible for up to 30% of epidural injections. The total cost of surgery for LSS reached 1.65 billion dollars in the USA in 2007 (*6*).

Conservative treatment options for DLSS include medication, physical therapy, bracing and epidural injections. However, only limited evidence-based information is available as to which treatment should be selected. Recently, two large RCTs with

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follow-up periods of up to 4 years have shown that surgery is superior to conservative treatment regarding pain and function (*15,35*). A number of surgical techniques are used to treat DLSS, the most common being decompressive laminectomy (*9*). Surgical failures are mainly due to local tissue trauma and to iatrogenic spinal instability, leading to an increase in fusion procedures (*3,5,6,8,18,28*). This has fostered the development of less invasive techniques. Unilateral laminotomy for bilateral decompression (ULBD) with undercutting technique achieves sufficient decompression with similar or better long-term results than laminectomy, while reducing iatrogenic instability (*3,5,12,18,28*). Success rates and advantages of ULBD in comparison with laminectomy have been extensively studied. However, few studies focus on the incidence of early complications (*9*). This paper compares short-term complication rates in younger patients (< 65) and older patients (> 65), in order to evaluate the safety of ULBD in the elderly.

PATIENTS AND METHODS

Study design

This retrospective study includes all patients, meeting the inclusion criteria, who underwent ULBD for DLSS in the Europe Hospitals in Brussels in 2011. Inclusion criteria were : symptomatic LSS (claudication or radicular symptoms increased by standing or walking and decreased by flexion), confirmed by CT or MRI imaging, and refractory to conservative treatment for at least 3 months. Paralysis, incontinence or rapidly progressing symptoms were considered to be an emergency and were treated surgically without prior conservative treatment. Exclusion criteria were : 1) a history of previous spinal surgery, 2) coincident herniated disc surgery and 3) patients with marked spondylolisthesis grade 2 or more on standing radiographs. All surgery was performed by a single surgeon, experienced in spinal surgery (PL).

Short-term (within 4 weeks) complications of ULBD, including peroperative dural tears, postoperative CSF leaks, root damage, wound infections, spinal haematomas, short-term surgery-induced instability and short-term re-operation rates were recorded. Furthermore CRP levels were measured one day postoperatively, to check the invasiveness of ULBD. All information was deduced from the electronic patient files, including detailed written reports concerning surgery, hospital stay and follow-up appointment, laboratory results and imaging. Postoperative spinal instability was clinically suspected in patients with increased low back pain and decreased functional performance, after which radiological examination was performed. Subjects were divided into two age groups : younger and older than 65.

Fisher's exact test was used for statistical computation. A p value < 0.05 was considered as significant.

Surgical Technique

Surgery was performed under general anaesthesia in the genupectoral position. Fluoroscopic verification of the correct levels determined the location of the midline skin incision. Muscles were detached from their attachments on the facet joints, laminae and spinous processes, on the side which was clinically and radiologically dominant. The inferior aspect of the superior hemilamina and the superior aspect of the inferior hemilamina were resected with Kerrison rongeurs and a high speed drill. Subsequently flavectomy was performed until the dura was visualized. The hypertrophied medial side of the facet joints was partially removed, and the lateral recess was cleaned. Undercutting of the spinous process with a high-speed drill provided excellent visibility of the contralateral side. Contralateral decompression was then realized in the same manner. Sufficient decompression of the nerve root was tested by sliding a blunt instrument along its course. This procedure was repeated on every level where LSS (Lumbar Spinal Stenosis) was radiologically and clinically present. The spinous processes, the supra- and interspinous ligaments, most of the laminae and the contralateral musculature were left intact, thus minimally disrupting the spinal integrity. Dural tears were sutured peroperatively, if possible. Inaccessible tears were eventually treated with synthetic absorbable hydrogel (DuraSeal™ , Covidien), haemostatic cellulose polymer (Surgicel®, Ethicon) or muscular flaps, but this was not necessary in the current series. Subsequently all treated levels were rinsed. Fascia, subcutaneous tissues and skin were closed. A suction drain was used in all cases and removed after 24-48 hours. All patients were mobilized 6 hours postoperatively, except after suture of dural tears, where a supine position was maintained for 24 hours. Patients received in-house physical therapy until acceptable recovery was obtained for discharge. Pain medication was given on a demand basis. All patients had a clinical follow-up appointment 4 weeks postoperatively, and also later in case of unfavourable clinical evolution.

Table I. — Distribution of complications

	N° of patients n = 29	% of patients	Age < 65 n = 12	Age > 65 n = 17
Dural tears	3	10.3	0	3
Postop. CSF leak	0	0	0	0
Root damage	1	3.4	0	1
Infection	0	0	0	0
Haematoma	0	0	0	0
Instability	0	0	0	0
Re-operation	1	3.4	0	1
Total	5	17.1	0	5

RESULTS

Demographic Data

Twenty-nine patients met the inclusion criteria. Their mean age was 67.3 years (range, 29-87). The younger age group (< 65) included 12 patients (41%), the older age group (> 65) 17 (59%). There were 18 women (62.1%), and 11 men (37.9%). The preoperative CT or MRI showed one-level stenosis in 10.3%, two-level stenosis in 13.8%, three-level stenosis in 58.6%, four-level stenosis in 13.8%, and five-level stenosis in 3.4%. ULBD was performed on a total of 83 levels. The distribution of the 83 laminotomies was as follows : L1L2 comprised 4.8% of all laminotomies, L2L3 :16.9%, L3L4 : 31.3%, L4L5 : 30.1% and L5S1 :16.9%. No patients were lost to follow-up.

Complication rates

A *dural tear* occurred in 3 patients (10.3%) (Table I). All tears were successfully sutured peroperatively, without subsequent CFS leakage. One of these patients had extensive fibrosis, extending onto the dura mater, most likely due to severe stenosis, which predisposed him to this dural tear.

Neural damage. One patient (3.4%), treated for progressive paralysis, and also affected by a dural tear, suffered from limited peroperative trauma to the L3 nerve root. Initially he recovered very well, without symptoms linked to the nerve damage. But 2 days postoperatively he slipped out of bed, which resulted in a vertebral fracture and disk herniation, requiring additional surgery, after which pain and muscle weakness persisted. This made specific follow-up of this possibly surgery-related neural injury unreliable.

Other complications. No superficial or deep wound infection, spinal haematoma, or postoperative instability were observed. One patient was admitted to the emergency room because of accidental opiate overdose, but hospitalisation was not needed. No major medical complications or death occurred.

Re-operation. One patient (3.4%) underwent a surgery-related re-operation. The patient presented 4 weeks postoperatively with an inflamed wound. The scar was incised the next day and a sero-sanguinous collection was found underneath the skin. Anatomo-pathological and bacteriological examination were normal. The wound was rinsed and closed. No further wound healing problems were seen. An other patient (3.4%) required non surgery-related re-operation after a traumatic post-operative vertebral fracture, as mentioned above.

Complications as a function of age. No complications were noted in the younger age group, versus 5 in the older age group. However, the difference was not statistically significant.

CRP levels one day postoperatively

CRP levels were measured one day postoperatively to asses the degree of invasiveness of ULBD. The mean value for all patients was 19.87 mg/L (standard deviation 17.55 mg/L). The mean value for patients younger than 65 years of age was 18.87 mg/L, and 20.74 mg/L for patients older than

65. The difference was not statistically significant : p = 0.6084.

DISCUSSION

Success rate

Several surgical techniques for LSS exist. Laminectomy has a success rate of 64%, according to a meta-analysis of 74 studies with follow-up up to 6 years (*34*). Bilateral dissection of the paraspinal musculature and removal of osteoligamentous structures result in increased surgical trauma in comparison to less invasive techniques. Surgical failure is mostly due to increased rates of spinal instability, leading to fusion procedures (*3,5,6,18,28*). However, a study comprising over 32,000 patients concluded that fusion procedures have a two-fold increase in re-hospitalization rates, a three-fold increase in major medical complications, and a four-fold increase in cost (*18*). Furthermore, evidence for increased efficacy for more invasive procedures is lacking (*9*).

First described by Young in 1988 (*37*), ULBD has reported success rates of 80-90% at 1 year, 68-87% at 2 years, 85% at 3 years and 85.3% at 5.6 years (*2,5,11,18,19,28,29,36,37*).

To the authors' knowledge, this is the first study focussing specifically on short-term complication rates after ULBD, and comparing complication incidences between age groups. A limitation of this study is the fact that it was limited to short-term complications.

Short-term surgical complications

Dural tears. Accidental durotomy rates range from 1.1 to 12% for ULBD (*3,5,12,20,21,27,28*) and from 5 to 15% (*14,26,28,32,35*) for laminectomy. The authors encountered this complication in 10.3% of their patients : in the same range. Wang *et al* (*32*) studied 88 patients incurring dural tears during spinal surgery and found no association with long-term deleterious effects. The authors' experience and that of others is in agreement with this finding (*3,19,28*). However, dural tears are associated with increased operation time and blood loss (*32*). In most cases, dural tears can be treated successfully during surgery. Postoperative CSF fistulas are encountered in 0 to 1.5% (*3,5,19,21,28*) of decompressive interventions using ULBD, sometimes necessitating re-operation. This complication was not seen in the current study. Thus, one may conclude that the most commonly encountered complication (dural tear) does not occur more frequently in ULBD than in the standard technique, and that it does not seem to be associated with serious long-term effects (CSF leak).

Neural damage. Early reports on ULBD mentioned increased rates of neural injury for less invasive techniques, raising questions about their safety (*24*). However, since then these complications have rarely been reported. Verbiest (*31*) found radicular symptoms to occur in 5% of all laminectomies. Series of ULBD showed this complication in 0% (*3,5,18,19*), 3% (*21*), and 4.2% (*12*). The current series includes one patient (3.4%) with potential peroperative neural trauma : in the same range.

Other complications. The wound infection rate is approximately 1.9% after spinal surgery in general (*38*). As to DLSS, rates of wound problems increase with revision surgery (1% vs 4.6%) (*6*). Turner's meta-analysis (*30*) demonstrated deep infection in 1.08% and superficial infection in 2.30% of the laminectomies. Another study (*33*) reported wound infection in 2.05% (8 of 391 patients) of the laminectomies. Wound infection rates for ULBD range from 0 to 2.4% (*3,5,19,21,28*). The current study includes one patient (3.4%) with sterile wound inflammation, healed after débridement. Again in the same range.

Compressive epidural haematoma is a rare complication after ULBD, ranging from 0% (*3,5,10,18, 19,21*) to 5% (*28*). A multicenter study found this complication in 4 out of 391 laminectomies (1.02%) (*33*). No epidural haematomas were encountered in the current series.

CRP levels

Data on postoperative CRP levels after multilevel ULBD are lacking in the literature. A clear association between CRP levels and severity of peroperative trauma has been demonstrated (*1,13,*

24). Al-Jabi *et al* (*1*) found CRP levels of 90 mg/L one day after open laminectomy. Houten *et al* (*13*) found peak CRP levels of 31.8 mg/L after open multilevel fusion. An other study reported CRP levels of 54.4 mg/L one day after open unilateral laminotomy (*24*). We found an average CRP value of 19.87 mg/L, one day postoperatively. This low value pleads for the less invasive nature of ULBD.

Postoperative instability

Laminectomy uses wide and bilateral retraction of the paravertebral muscles. This may lead to muscular atrophy and chronic denervation, causing decreased paravertebral strength (*17,24*). ULBD does not mobilize the paravertebral muscles as far laterally, and spares the contralateral musculature, thus limiting soft-tissue trauma and avoiding long-term dysfunction of the paravertebral musculature.

Re-operation

After ULBD, re-operation rates of 0% (*5*), 3% (*3*), 4.2% (*21*), 7.7% (*28*) and 27.5% (*19*) have been reported. Thomé (*28*) found 7.7% re-operations in the ULBD group, and 11.8% re-operations in the laminectomy group. Large variations in reported re-operation rates might be explained by the lack of long-term follow-up in some studies. Lower re-operation rates after ULBD when compared to laminectomy might be explained by a decreased rate of bony regrowth because of better preservation of spinal stability (*4*). In the current study, focussing on short-term complications of ULDB, one patient (3.4%) underwent short-term surgery-related re-operation for wound healing problems : again in the same range. However, the short follow-up period limits valid statements on long-term re-operation rates. Another patient (3.4%) underwent non-ULDB related re-operation after traumatic vertebral fracture and disk herniation.

Age

Old age has traditionally been regarded as a relative contraindication for surgical treatment of LSS, as laminectomy is considered invasive and prone to causing postoperative instability. However, as to ULBD, advanced age does not seem to be a negative predictive factor (*5,19,21,24*). To the authors' knowledge few studies have focussed specifically on whether complication rates increase with age after ULBD. Deyo *et al* (*6*) found that major medical complications and mortality modestly increase with age. However, the reported complications were limited to infections, haemorrhagic complications and wound problems, thus not reporting on the most common complications such as dural tears. The current study demonstated an increased rate of short-term surgical complications in the older age group. This may be explained by the presence of weaker structures or more degenerative changes in the elderly. However, with the exception of a possible radicular conflict, these complications had no proven long-term relevance and thus did not increase morbidity in these older patients.

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