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Ten- to 15-year outcome of surgery for lumbar disc herniation: radiographic instability and clinical findings

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Abstract The most appropriate treatment for radiculopathy associated with disc pathology is still controversial. Since 1934, surgical treatment has consisted of hemilaminectomy and removal of the herniated material. Many authors believe that these procedures may cause degenerative spondylosis and vertebral instability. Several surgical methods have been proposed, but the long-term effects are still being debated. In addition there appear to be few well-designed outcome studies on the management of this disease. In the present study, 150 patients were selected for surgery with strict criteria and all treated with the standard technique. The series was evaluated by subjective analyses (Roland questionnaire; 120 patients), objective examinations (68 patients – 56.6%) and radiographic studies including dynamic views (analyzed by the Taillard and Boxall methods) to establish the presence of vertebral instability (50 patients – 41.6%). The subjective and objective analyses showed a high rate of good results. Radiographic studies showed vertebral instability in 30 cases, but only 9 were symptomatic. Recurrences were not observed and only a few patients suffered from leg pain. The standard procedure for lumbar disc herniation showed good results at 10- and 15-year follow-up.

Key words Lumbar disc herniation · Surgery · Vertebral instability · Clinical outcome · Questionnaire

Introduction

The aim of surgical treatment of radiculopathy from herniation of nucleus pulposus is to decompress the nerve root and remove the herniated tissue. Since 1934, surgical treatment has consisted of hemilaminectomy and removal of the herniated disc [17]. Several experimental reports have examined the effects of spinal surgery on vertebral instability [1, 9].

Since the late 1970 s, new surgical techniques (microsurgery, chemonucleolysis, etc.) have been proposed [5, 20, 25] and both the advantages and disadvantages, as well as the comparative results of these techniques, have been greatly debated [3, 14, 19, 28, 30]. Keller et al. observed that there is a paucity of well-designed outcome studies on the management of herniated lumbar disc [15], while Albert and co-workers reported that there is no outcome assessment [2].

The aim of the present study was to evaluate the outcome of standard surgery for disc herniation by means of an analysis of long-term results in a large number of treated patients. The results, clinically evaluated by the physicians, were analyzed by the Roland questionnaire for low back pain [22], while the method proposed by Sato and Kikuchi [24] was employed to evaluate vertebral instability. In agreement with Johnson, the authors believe that a complete evaluation of the results of spinal surgery must be both subjective and objective [11].

Materials and methods

A retrospective study was conducted on 150 consecutive patients submitted to surgery between 1980 and 1986 for herniated lumbar disc with radiculopathy. Of the initial population (150 patients), we re-contacted 120 patients; we were not able to find the other 30.

Selection

Eligibility criteria included:

1. Persistent (more than 6 weeks) sciatica resistant to conservative treatment or with neurological loss
2. Clinically determined radiculopathy at level L4, L5 or S1
3. Positive imaging study (myelography or CT) for disc herniation
4. Electromyelography (EMG) to assess the neurological status in cases where the clinical level was uncertain and
5. No prior lumbar surgery, infection, fracture, tumor, or deformity

Clinical data

The mean age of the patients was 41.4 years (range 27–65 years). There were 103 men and 47 women. In all of the cases, only one level was decompressed: in 1 case at level L3-L4, in 42 cases at L4-L5, and in 77 cases at L5-S1. Vertebral instability signs (e.g. olisthesis), evaluated by means of preoperative lumbo-sacral standard radiographs, were not observed in any of the patients.

The studied population preoperatively presented the following picture: 26 cases presented disc bulging with associated intervertebral foramen stenosis; 94 cases presented displacement disc hernia. The disc herniation was localized into the intervertebral foramen in 29 out of these 94 patients.

Surgical technique

All the patients were operated upon by the same surgeon (S.P.). The level of the surgical approach was chosen on the basis of clinical findings, confirmed by imaging (myelography and/or CT scan). In 32 cases (21.3%) with weak pathological imaging findings, an extended EMG of the L3-S1 methameric muscles was performed in order to confirm the level and exclude distal neuropathy (especially for peroneal nerve lesions, which may mimic an L4-L5 radiculopathy).

All the operations were conducted in the lateral knee-elbow position. Patients routinely underwent hemilaminectomy and partial arthrectomy with excision of the ligamentum flavum and removal of herniated disc material. The compressed nerve root was always examined along its course to the foramen and, where necessary, a partial foraminotomy was performed (90 cases). The procedure was completed by disc exploration in some selected cases. The patients were allowed to stand 48 h after surgery and restricted activity was recommended for 2–3 weeks. Braces were not prescribed in any cases.

Follow-up evaluation

The long-term results were evaluated by means of subjective and objective clinical data, imaging, and EMG when residual neurological damage was suspected. The follow-up at the time of this investigation ranged from a minimum of 10 years to a maximum of 15 (mean 12.1 years).

Table 1 Items and scores on the presence of leg pain and satisfaction with surgery

Buttock and/or thigh pain[a]	
Severe	0 (0%)
Moderate	12 (10%)
None	108 (90%)
Calf and/or foot pain[a]	
Severe	0 (0%)
Moderate	9 (7.5%)
None	111 (92.5%)
Satisfaction with surgery	
Yes	92 (76.6%)
Quite	23 (19.2%)
No	5 (4.2%)
Reoperation at the same level	
Yes	0 (0%)
No	120 (100%)

[a] Responses to the question ‘In the last month, on a typical day, how would you describe…’

Subjective analysis

The Roland Disability Questionnaire (RDQ) with an additional four items regarding the presence of peripheral pain, satisfaction with surgery (similar to the Stucki questionnaire [26]) and eventual reoperation (Table 1) was sent to all the patients. A total of 120 patients (80%) completed and returned their questionnaire.

Objective analysis

An accurate clinical evaluation was made, which included functional and neurological examinations by physicians who had had no previous relationship with the patients. Sixty-eight (56.6%) of the 120 patients underwent a clinical examination. Fifty-two (43.4%) refused because of complete recovery from symptoms. Three patients (2.5%) were evaluated with electrophysiologic examination because of moderate and persisting neurological symptoms.

Imaging

The following aspects were analyzed in the antero-posterior, lateral, and dynamic (flexion/extension) radiographic views (Figs. 1, 2):

1. Translation in flexion by the Taillard method (unstable level with slippage of at least 5%)
2. Posterior slippage in extension by the Taillard method (unstable level with slippage of at least 5%)
3. Posterior intervertebral space opening by the Boxall method (unstable levels with posterior openings of more than 5°), and
4. Osseous traction spurs

Radiographic views were obtained from 50 patients (41.6%). Eighteen refused to be subjected to X-rays.

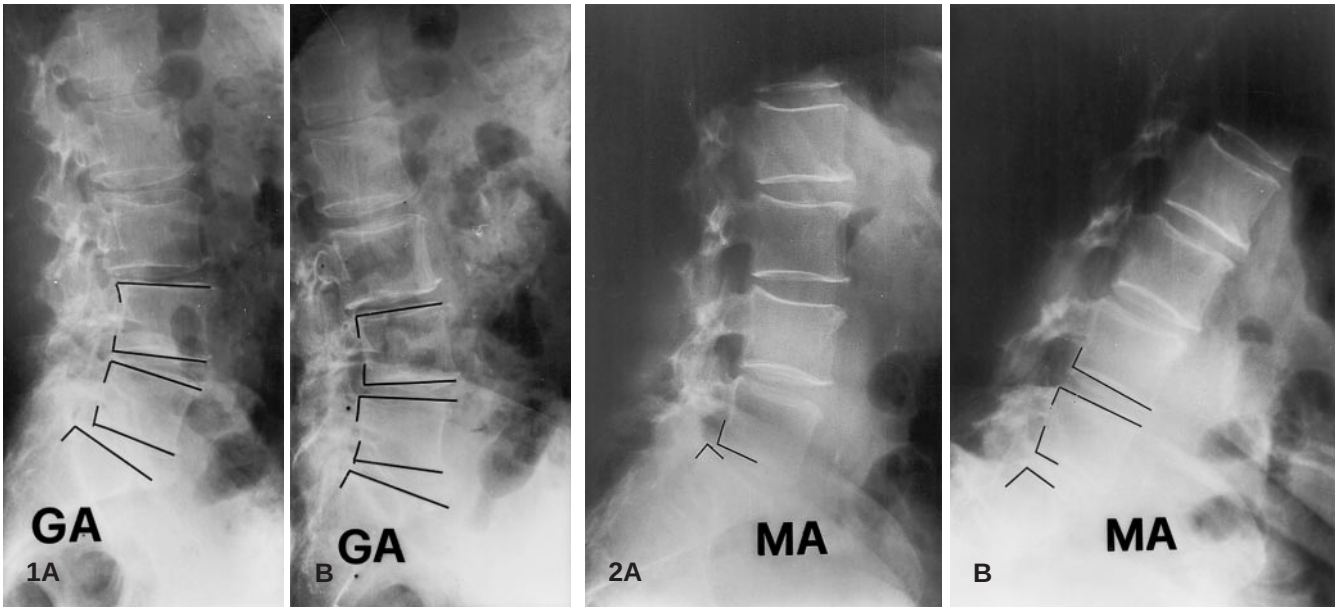

Fig. 1 A, B Patient no. 8 of Table 2. Male (G.A.), 72 years old, operated at L4/L5 level, with a Roland Disability Questionnaire (RDQ) score of 19 at 15-year follow-up. Lateral dynamic radiographs in **A** extension and **B** flexion show radiographic instability at levels L3/L4 and L5/S1 (type of instability according to Sato and Kikuchi [24]: L3/L4: 3, L5/S1: 5)

Fig. 2 A, B Female (M.A.), 72 years old, operated at L4/L5 level, with an RDQ score of 0 at 13-year follow-up. Lateral dynamic radiographs in **A** extension and **B** flexion show radiographic instability at levels L4/L5 and L5/S1 (type of instability according to Sato and Kikuchi [24]: L4/L5: 1, L5/S1: 2)

Results

Subjective

The Roland Disability Questionnaire (range 0 = no disability, 24 = severe disability) showed an average score of 4.3 (range = 0–23). Answers to questions regarding leg pain and irradiation are reported in Table 1. Ninety-five percent of the patients reported were satisfied with the results of surgery.

Objective

The 18 patients who refused imaging analyses at clinical evaluation presented neither lumbar nor radicular symptoms. Of the other 50, only 9 patients (13.2%) suffered low back pain with muscle contracture and clinically determined reduced range of motion (average RDQ score = 18, range = 14–23). In five cases, radiculopathy was clinically suspected and an EMG study proposed, which two patients refused. In the three cases evaluated, there were no signs of denervation.

Table 2 Results of radiographic study and the Roland Disability Questionnaire (RDQ) in symptomatic patients (n = 9)

Patient	Type of instability[a]	Surgical level	Instability level	RDQ score
1	1	L5–S1	L4–L5	16
2	3	L4–L5	L4–L5	17
3	3	L5–S1	L5–S1	23
4	1	L4–L5	L5–S1	17
5	4	L4–L5	L4–L5	19
6	1	L4–L5	L5–S1	14
7	3	L4–L5	L4–L5	21
8[b]	5	L4–L5	L3–L4 + L5–S1	19
9	6	L5–S1	L4–L5 + L5–S1	16

[a] Type of instability: 1 = posterior opening; 2 = forward translation in flexion; 3 = posterior slippage in extension; 4 = 1 + 2; 5 = 1 + 3; 6 = 1 + 2 + 3 (according to Sato and Kikuchi [24]
[b] See Fig. 1

Imaging

Spine radiographs showed vertebral instability in 30 cases. This evaluation, as proposed by Sato, showed 24 cases with grade 1, 2 or 3 and 6 cases with grade 4 or 5. Nine out of the 30 patients suffered from low back pain (Table 2). The remaining 21 were asymptomatic.

Discussion

The most appropriate treatment for radiculopathy associated with disc pathology is still the object of debate. Several authors have reported good results with conservative treatment [4, 21, 23, 29]. On the other hand, both

the American Academy of Orthopaedic Surgeons and Nachemson have established criteria for disc herniation surgery, similar to those employed in the present study [18].

Outcome studies of surgery for disc herniation have shown a 49–90% success rate [12, 13], similar to that reported here.

The overall results of the Roland questionnaire show a score of less than 5 in 107 of the 120 patients. All but 23.4% of the patients were entirely satisfied, while only 4.2% were unsatisfied. Leg pain also was considered a rare condition (Table 1).

In the series presented, reoperations at the same level were not necessary, although this is not in accord with other reports in the literature [6, 29]. Some authors suggest that some reoperations are due to incorrect indications for disc surgery [6, 12]. We believe that in our series the fact that second operations were never required is explained in part by the wide space created around the root, which the standard surgical procedure permits, and the foraminotomy, performed in 90 cases, which allows widening of the root course. Any possible occurrence of facet arthrosis or recidivism at the same level may impair the root less because of the "vital space" created by widening the course. The major objection to the standard technique is that the removal of bone structures (i.e. the articular facet, hemilamina, or ligament structures) may cause early degenerative spondylosis and/or vertebral instability [1, 14]. Postoperative hypermobility and/or instability seem to worsen the clinical results [10]. It is difficult to establish whether these phenomena are due to the natural history of degenerative disease or a result of surgery. Abumi et al. has suggested the possibility of a predisposition to vertebral instability [1]. Only 4.1% of our patients presented symptoms (low back pain without leg irradiation) and anatomical evidence of instability at the surgery level. The origin of low back pain is still unclear [8, 16] as is instability and its relationship with pain [7, 24, 27]. The fact that radiographic instability is not always accompanied by symptoms has already been reported in the literature [24].

In conclusion, we believe that the standard procedure for disc herniation is still a good treatment, given its safety and simplicity, unless there are elective indications for microinvasive techniques. Furthermore, we think that one of the most important steps for a good outcome in disc herniation is the indication for surgery, and further studies must be focused in order to define it.

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