Undercutting Laminectomy and Medial facetectomy for Lumbar Spinal Stenosis: Clinical and Radiological results

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Citation

R Sharma, L Lutchman, C Kabir, R Crawford. *Undercutting Laminectomy and Medial facetectomy for Lumbar Spinal Stenosis: Clinical and Radiological results*. The Internet Journal of Orthopedic Surgery. 2007 Volume 9 Number 1.

Abstract

Study design: A retrospective study to assess the outcome following undercutting laminectomy and medial facetectomy for the treatment of Lumbar Spinal Stenosis (LSS).

Objectives:
To attempt to identify preoperative predictors of outcome for surgery for LSS. To assess the correlation between adequacies of decompression as judged on Magnetic Resonance Imaging (MRI) with clinical outcome.

Methods: A retrospective review of patient records of 47 patients with symptomatic LSS was conducted; Postoperatively a telephone interview and written questionnaire were used to rate patient pain, function and satisfaction. Pre and postoperative MRI scans were compared.

Results: 32/41 (78%) patients reported satisfaction with the outcome of surgery. The preoperative duration of symptoms was significantly longer in those patients who reported satisfaction with surgery. Postoperative symptoms are not related to patient satisfaction from surgery. Adequate decompression as judged from MRI scans was not found to correlate with patient satisfaction.

Conclusion: Undercutting laminectomy and medial facetectomy produces results comparable to published series.

SOURCE OF SUPPORT

One of the Authors is a research registrar supported by the commercial entity Zimmer (Warsaw, Indiana, USA) and is supported by a fund or grant in excess of £10,000 in one year.

KEY POINTS

- The technique of Undercutting Laminectomy and Medial Facetectomy for the treatment of LSS produces clinical outcomes comparable to those reported in the literature.
- There appears to be a relationship between outcome of surgery and duration of symptoms preoperatively.
- No other prognostic indicators of outcome from surgery could be identified.
- The degree of decompression as judged on MRI did not correlate with patient satisfaction with the surgical procedure.

INTRODUCTION

Lumbar spinal stenosis is defined as narrowing of the lumbar spinal canal resulting in entrapment and compression of intraspinal neural and vascular structures. The case for surgical decompression of the spinal canal and neural foramen is well established [1,2] .

There is however a trend towards more conservative bony resection in light of growing evidence that extensive bony resection may lead to spinal instability [3,4,5] . Quint and co-workers performed human cadaver work to support this hypothesis.

In view of these findings, several “minimally invasive” or more accurately “less destructive” surgical techniques have been described or are in development [6,7,8] . Kleeman [6] performed a wide fenestration and undercutting medial facetectomy and reported 88% good results at 4 years in 54 patients. Weiner [7] reported 66% satisfaction in 50 patients using the spinous process osteotomy described by Yong-Hing and Kirkaldy-Willis.

The results of surgical decompression for LSS reported in the literature have been very varied and sometimes inconsistent [9,10] . The possible reasons for this variation in good outcome include patient comorbidity and psychological factors, inadequacy of decompression and the wide variety of outcome measures that have been employed in the literature in order to define a successful surgical outcome. In this study, the patient reported satisfaction with surgery was chosen as the definition of a successful outcome. Patient reported satisfaction with intervention has been validated as an outcome measure [11] and has been employed in other studies [12] .

Other studies have employed general disease measures (e.g. the SF-36) and disease specific measures (e.g. Shuttle Walking test) in patient assessment. Patient satisfaction however, is arguably the most important factor to both the patient and surgeon following a surgical intervention.

MATERIALS AND METHODS

The records of a consecutive series of 47 patients who presented between January 1998 and December 2001 with clinical evidence of LSS and who subsequently underwent Undercutting Laminectomy and Medial facetectomy were reviewed.

Operative levels and complications were also retrieved from the records.

CLINICAL ASSESSMENT

Patient age, sex, symptom duration, walking distance, American Society of Anaesthеology (ASA) score and the presence of leg or back pain was noted. The operative records were reviewed to identify the levels decompressed and any intraoperative complications were noted. Patients who had had prior lumbar spine surgery, degenerative spondylolisthesis, degenerative scoliosis or on-going compensation claims were excluded.

Postoperative clinical assessment was performed using a telephone interview and a questionnaire. Patients were asked whether their walking distance had improved and whether or not their Activities of Daily Living (ADL) were limited. Subjects also completed Visual Analogue Scores for Back and Leg pain. Finally, patients were asked whether or not they were satisfied with the outcome of the surgery.

RADIOLOGICAL ASSESSMENT

All patients had MRI findings compatible with a diagnosis of LSS preoperatively. At 6 months postoperatively all patients underwent repeat MRI. The cross-sectional area of the spinal canal at the level of maximal stenosis was measured on preoperative axial T2-weighted scans. The PACS system was used and allowed computer aided measurement of canal area. The cross-sectional area at the “same” level was then measured on the postoperative MRI scans. Location of the level was facilitated by synchronous display of the sagittal scout image whilst viewing the axial images. The percentage change in cross-sectional area was calculated as shown in Figure 1.

SURGICAL TECHNIQUE

The surgical procedure consisted of a wide fenestration at the level to be decompressed. The inferior articular facet and lamina of the cranial vertebra was resected and the supero-medial aspect of the superior articular facet of the caudal vertebra excised to achieve an adequate decompression of the nerve root.

Figure 2A shows the completed resection. A fenestration was then performed at the level above.

Figure 2B shows a curved osteotome being used to undercut the lamina whilst protecting the dura with a MacDonald dissector. This has the effect of decompressing the central part of the spinal canal.

The surgical specimen consists of the resected ventral surface of the lamina and the attached ligamentum flavum.

STATISTICS

The main outcome measure was taken as patient-reported satisfaction or dissatisfaction with surgical treatment. Two outcome groups were therefore defined. Statistical analysis was performed using the Sigmastat software package.

Age and Duration of follow-up were found to yield normally distributed data and were analysed using the t-test.

All other variables were found to not be normally distributed and were analysed using the Mann-Whitney non-parametric test.

RESULTS

CLINICAL OUTCOME

Forty-seven (47) patients were recruited. Full clinical data was available for 41 patients and complete radiologic data retrieved for 30 patients. Complete clinical and radiological data was retrieved for 24(51%) of patients. The mean duration of follow-up was 31.4 months(Range 12-72).

Of the 41 patients on whom clinical data was available, 10(24%) patients were ASA grade 3 which reflects the frequent coexistence of medical comorbidity in this group of patients. 32(78%) of patients had both leg and back pain at presentation.

32 (78%) patients reported satisfaction with the outcome from surgery. Of the 32 patients who were satisfied with the operation however, 13

(40%) patients reported significant limitation of their ADL. All but 1 of the dissatisfied patients had limitation of ADL. Limitation of ADL was therefore not found to be correlated with outcome from surgery.

Table 1 shows the mean values for Age, Duration of follow-up, Number of Level Decompressed, ASA score, Back and Leg pain postoperatively and Duration of Symptoms prior to surgery for each of the two main outcome groups. None of these was found to show a statistically significant difference between the two groups.

The duration of symptoms in the Satisfied group was found to be 47 months compared to 21 months in the Dissatisfied group. This was found to be significantly different (p=0.04).

COMPLICATIONS

Three CSF leaks were noted and repaired at the time of surgery. All of these patients had had three-level decompressions.

One patient had a superficial wound infection which settled with antibiotic therapy.

No cases of postoperative spondylolisthesis have as yet been identified.

RADIOLOGICAL OUTCOME

Complete radiological data was retrieved on 30 patients. Figure 3 shows a scatter plot of the radiological outcome in the two outcome groups. The distribution is similar for both groups and was not found to be significant although given the small number of Dissatisfied patient on whom full radiological data was retrieved, the power is very low and there is a high likelihood of a ? error. However, the magnitude of the increase in spinal canal cross-sectional area following surgical decompression does not appear to correlate with patient satisfaction.

DISCUSSION

The results of surgical decompression for LSS are highly variable. Reported success rates vary from 26 to 100 % [9] . The possible factors that may account for this variation include patient factors, surgical factors and assessment factors. Several authors have attempted to clarify the reasons for the wide variation in surgical outcomes [13] . These include patient comorbidity [14] and psychological factors [15] .

Many studies have not taken into account such factors as patient comorbidity, expectations or psychological factors. This elderly group of patients often have cardiac, respiratory and vascular pathology that make objective assessment of outcome of LSS surgery difficult to quantify. There is considerable evidence to show that the outcome of surgery is to some extent determined but psychological factors and most studies of surgery for LSS, including this one, have not assessed these in this elderly population.

The clinical history of spinal claudicaition is readily recognised but given the general paucity of localising signs, clinicians rely greatly on preoperative imaging in order to identify the site and level of stenosis. CT myelography is regarded the “gold-standard” [16] but is invasive and has been largely superseded by MRI. There are few reports in the literature in which MRI has been the definitive radiological investigation. Early reports relying solely on CT may have underestimated the degree or extent of compression. CT may underestimate the degree of compression attributable to the disc, facet joints and ligamentum flavum. Many clinicians however continue to use CT preoperatively given its wider availability and lower cost. All patients in this series had MRI follow-up. It is imperative that the site of compression be it central, lateral recess or foraminal be identified preoperatively if properly directed decompression is to be achieved.

The plethora of surgical procedures that have been used in decompression of LSS include extensive laminectomy ("Christmas-tree" procedure), "Port-hole" laminectomy [6], expansive laminoplasty [17], spinous process osteotomy [7], endoscopic laminectomy [8] and now Undercutting Laminectomy. None of these has been shown to yield superior results and as long as complete neural decompression has been achieved one would expect to see no difference. Conventional laminectomy effectively decompresses the neural elements but may do so at the expense of spinal stability. Surgical techniques that preserve the posterior spinal elements have the theoretical advantage of maintaining spinal stability as the osseous integrity of the segment is less likely to be compromised. It is yet to be seen whether the incidence of later spondylolisthesis using these techniques is less when compared to conventional laminectomy.

There are a wide variety of instruments that have been used to assess outcome [18,19]. The definition of a successful outcome is therefore very variable across the literature. Disease-specific measures (like the ODI) [20] and general health measures (SF-36) have been used by other authors. Functional measures (Shuttle-walking test) are compromised by the frequent comorbidity in this patient group and may not accurately reflect the neural compression element of the patient's disease. Patient satisfaction is arguably the most important outcome measure for both patient and surgeon and for this reason has been employed in this study.

Much attention has been paid to elucidating preoperative factors that may better predict those patients who respond favourably to surgical treatment. The overall impression from the literature is that there are no clear predictors of outcome from surgery. Our finding of better satisfaction with longer duration of symptoms is difficult to explain. One reason may be that the patients' subjective relief following surgery is greater the longer their duration of symptoms.

There have been published reports which demonstrate that the adequacy of decompression as judged by Computerised Tomography (CT) does not correlate with patient-reported outcome [21]. This is supported by our findings using MRI as the imaging modality.

Undercutting laminectomy and Medial factectomy produces complete neural decompression and patient-reported satisfaction following the procedure was comparable to that reported in the literature using more destructive conventional techniques. No increased incidence of complications was noted. Preoperative length of symptoms has been identified as a possible predictor of surgical outcome. No other variables were found to be of predictive value. Postoperative pain and limitation of ADL does not necessarily correlate with patient satisfaction and adequate decompression as judged by MRI does not predict a satisfactory clinical outcome.

This study is limited by the small patient sample and the consequent low statistical power. No preoperative quantitative data was available to allow comparison using validated instruments but patient satisfaction is arguably the most relevant outcome measure for both surgeon and patient. The Interobserver error in assessing cross-sectional area of the spinal canal, using the method that we employed has not been assessed but is under investigation.

Undercutting laminectomy and Medial facetectomy, by preserving the posterior elements, may lessen the incidence of post-decompression spondylolisthesis but this requires further study ideally using a randomised group of patients followed-up for many years.

Greater number of patients is required to improve statistical power but this is difficult without multicentre trials.

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