AUTOMATED PERCUTANEOUS LUMBAR DISCECTOMY

AN OUTCOME STUDY

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We treated 137 patients with symptomatic lumbar disc prolapse by automated percutaneous lumbar discectomy (APLD). Seventeen (12%) required further operation. At a mean follow-up of 55 months, the success rate was 45%. Of those who had APLD alone, 52% were graded as either excellent or good. In this group, 76% were employed, and the mean Oswestry score was 28.2%. One-third of those patients initially rated as successful had deterioration in symptoms and increased disability from back pain. The Short Form 36 health survey questionnaire revealed that these patients had a chronic ill-health profile.

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The treatment of symptomatic herniation of the lumbar disc has evolved continuously since Mixter and Barr described surgical excision of the disc in 1934. Surgeons have sought means of reducing the operative trauma to the spine by adopting minimal interventional techniques. In 1975 Hiji-kata et al performed the first percutaneous discectomy using modified pituitary rongeurs. A decade later Onik et al (1985) described their experience with percutaneous discectomy using an automated reciprocating suction cutter (nucleotome). The mechanism of action was thought to be indirect reduction of the disc hernia by an intranuclear ‘vacuum’ phenomenon. An early success rate of 70% was reported and this has been confirmed by others (Davis and Onik 1989; Goldstein, Mink and Dawson 1989; Maroon, Onik and Sterna 1989). Despite the widespread adoption of this technique there are few reports of longer-term results. We present an outcome study of patients treated by automated percutaneous lumbar discectomy (APLD).

PATIENTS AND METHODS

Between May 1988 and October 1990, we used APLD to treat 137 patients with lumbar disc hernia. There were 70 men and 67 women with a mean age of 33 years (SD 10; range 17 to 57). Patients were considered for APLD if there were predominant leg symptoms, a radicular pain distribution, restricted straight-leg raise and positive signs of nerve-root tension. We excluded those with symptoms suggestive of facet arthrosis or neurogenic claudication and those whose plain radiographs showed more than 50% loss of disc height at the relevant level. Conservative treatment, including physiotherapy and epidural injections, had failed. Many of the patients had had previous chronic back pain but the mean period of disabling radicular symptoms was 16 months (3 to 26). No patient was pursuing litigation for compensation. In most, MRI had confirmed the diagnosis of disc protrusion. Patients in whom the protrusion occupied more than 50% of the sagittal diameter of the spinal canal or in whom sequestrated fragments were seen on MRI were treated by open discectomy.

Operative technique. All operations were performed by surgeons experienced in discography and chymopapain nucleolysis. Prophylactic antibiotics were given and discography was performed before APLD to confirm a contained herniation. We used a standard technique (Maroon et al 1989) with a 2 mm diameter nucleotome (Surgical Dynamics Inc, Alameda, California) (Fig. 1) and performed an equal number of procedures at L4/5 and L5/S1. On each occasion the amount of disc material aspirated was recorded. Patients were mobilised the next day and most were discharged from hospital within two days.

Patients were regularly reviewed and the pain level, functional impairment and the activities of daily living, including sport and social activities, were recorded. All were sent postal questionnaires including the Oswestry Back Disability form (Fairbank et al 1980) and Short Form 36 (SF36) (Garratt et al 1993) together with a visual analogue scale (VAS) with end points of ‘no pain at all’ and ‘worst pain imaginable’. Those who had not replied within six weeks were traced through the Family Health Services Authority records, and sent reminders. Respondents were interviewed by an independent assessor (Amcl) who had
not been involved in their care. A Low Back outcome score was then calculated from the acquired data (Greenough and Fraser 1992).

RESULTS

Wilson and Kerslake (1993) have reported the early results of the first 50 consecutive patients in our series. Thirty-six (72%) had an excellent or good result when reviewed at one year. There was no correlation between the success rate and the volume of disc material removed.

At this latest review, five patients had left the Nottingham region and were untraced. Of the remainder 16 failed to respond and one had died. A total of 115 patients were therefore reviewed giving a follow-up rate of 84%. The mean follow-up period for the respondents was 55 months (sd 10; range 44 to 71).

Seventeen patients had a further operation after their initial APLD; this group is referred to as 'surgical'. Those who had APLD alone are referred to as the 'APLD' group (120 patients). Fifteen patients from the former group and 100 patients from the latter were interviewed.

At latest review, 76% of the APLD group were in full or part-time employment. The mean Oswestry score was 28.2% (95% CI: 23.2 to 33.3) the mean outcome score was 49.7 (95% CI: 45.8 to 53.7). Using criteria defined by Greenough and Fraser (1992), 33% of the results were graded excellent, 19% good, 30% fair and 18% poor. No patient had a recurrence of radicular symptoms which required further investigation. If patients with a fair or poor outcome and those who had a further operation are considered as 'failures', the overall success rate was 45% (52/115).

The mean transformed scores from the SF36 questionnaires were calculated for each outcome grade. The scores for each variable are linked to form a 'health profile'; the profile for each grade is illustrated in Figure 2. In each successive grade there is a progressive decrease in the mean scores for each SF36 variable. The most discriminant variables were physical functioning, role impairment (physical) and pain (items 1, 3 and 7).

There was no correlation between the Oswestry and Low Back outcome scores and the age, duration of preoperative symptoms, mental health scores or health perception. There was no significant difference between the respondents and non-respondents in terms of age, sex distribution, period of preoperative disability or employment status.

The first 50 consecutive patients were traced and all responded. Of the 36 patients initially graded as either excellent or good, none had had any further spinal procedure during the follow-up period. Twenty-four (67%) from this subgroup remained in the same category but 12 (33%) had deteriorated to either fair or poor.

Twelve patients required open discectomy and/or nerve-root decompression within three months of APLD. The main indications for the second operation were unresolved lower pain with persistent signs of nerve-root tension. Sequestered disc prolapses were found in two patients. Five had late operation, four with spinal fusion and one with a Graf stabilisation. The surgical reintervention rate was 12%, and two patients in this group were not traced. Of this surgical group, 69% were employed at this latest review. The mean Oswestry and outcome scores were 37.2% (95% CI: 20.2 to 54.2) and 49.7 (95% CI: 40.4 to 59.0) respectively. Three (20%) patients were graded excellent, 5 (33%) good, 4 (27%) fair and 3 (20%) poor.

The APLD and surgical groups were comparable in terms of age, sex distribution, and length of follow-up. There was no significant difference in the employment rate (chi-squared test) or mean Oswestry or outcome scores between the groups.

There was no significant difference in the SF36 scores of the APLD group and a patient population which reported chronic ill health (Fig. 3) (Jenkins, Coulter and Wright 1993).

DISCUSSION

The mechanism by which APLD acts on the intervertebral disc remains obscure. Using sophisticated measurement techniques, Castro et al (1993) found reduced disc pressures after APLD in cadaver spines. We have observed similar changes in cadaver studies, but believe that these are creep-related phenomena rather than due to an active effect of APLD (Grevitt 1994, unpublished data). They may explain, however, the clinical observation that the early outcome of APLD correlates poorly with the volume of disc material aspirated, and that failure is more likely with larger disc herniations (Wilson and Kerslake 1993). There is no substantive experimental evidence to support the
The perception of disc herniations can occur due to various factors, including the degenerative nature of the disc and biomechanical changes. However, the reported success rates of surgical interventions like discectomy can vary significantly.

Onik et al. (1987) presented the results of a prospective study of APLD therapy. They recruited patients with compensation claims, previous spinal surgery, and other causes of back pain, and reported an 86% success rate within four months after treatment. When compensation patients were considered, the success rate fell to 70% (Davis and Onik, 1989; Maroon et al., 1989). These reports indicate that radicular symptoms may have resolved spontaneously in some cases. A study by Kahanovitz et al. (1990) showed that 55% of patients could return to work following the procedure.

There are few reports of long-term outcomes of APLD. Shepperd (1992) had an initial success rate of 63%, but after follow-up of three to eight years, 4 out of 27 patients had a further disc herniation at the same level. Another series of 80 patients reviewed at a mean interval of three years showed success rates at 93% and 65% in private and compensation patients, respectively. The method of assessment was not stated (Gill, 1991).

Because of the circumstances of the study, the average preoperative disability period is longer compared to other reports, and none of the patients showed evidence of natural resolution of their symptoms. The inclusion criteria were similar to those in other reports, and this is reflected in the comparable early success rates of APLD.

APLD is effective in relieving radicular symptoms and allowing resumption of normal activities. There were no late operations for recurrent disc herniations. The success rate of APLD was similar to that reported in previous studies.

We managed to achieve a follow-up rate of 84%, but analysis of the non-respondents showed no significant differences in age, sex, or demographic details. We were able to contact all of the first 50 APLD patients, and comparison of their results with the overall APLD group revealed no difference in late disability or outcome. We are confident that our results give a true representation of the late outcome of APLD.

APLD is successful in relieving radicular symptoms and allowing resumption of normal activities. There were no late operations for recurrent disc herniations. In our study, we have used validated outcome measures that are more comprehensive than those used in previous reports.

Although we have defined a patient who had a further spinal operation as a ‘failure’ the late operations were performed for disabling chronic back pain rather than radicular pain. The lumbar spine is a continuously decaying structure and after lumbar disc excision 14% to 30% of patients may have significant low back pain (Weber, 1983; Hanley and Shapiro, 1989). Our study shows that a minimally invasive technique such as APLD does not alter this process. The Low Back outcome scores indicate that the level of physical disability increased during follow-up; only 52% had an excellent or good outcome at a mean of 55 months. One-third of those initially classified as having a successful result had deteriorated to a fair/poor result at the late review.

We believe this to be the first report of the use of the SF36 assessment form in assessing the results of operations on the lumbar spine. There was a progressive deterioration...
in the ‘health profile’ with each successive outcome grade and the health profile of the APLD group was similar to that of a patient population which reports chronic ill health (Jenkinson et al 1993). The mean transformed scores for the variables of mental health, energy/vitality and health perception were significantly lower than those of the general population.

Although 76% of our patients were employed the SF36 revealed a significant degree of physical and social impairment, demonstrating that the use of employment rates as a measure of success in spinal surgery underestimates the true morbidity. Employment rates are influenced by cultural and socio-economic factors and their use in making international comparisons of a technique should be avoided.

Few prospective studies compare the outcome of percutaneous discectomy with an ‘open’ technique. Mayer and Brock (1993) gave preliminary results of a randomised, prospective trial comparing percutaneous endoscopic discectomy with microdiscectomy. Those who had percutaneous discectomy had a shorter period of postoperative disability and a greater rate of employment when assessed at a mean of two years. The reduced success rate (70%) of microdiscectomy compared with other reports was explained by “the sociomedical situation in Germany, where loss of income due to disability is generously covered by legal insurance”.

In the UK there is no comparable insurance system and state-financed disability payments are relatively modest. This may account for the disparity between the high employment rate and the increased level of disability from back pain in our study. Although our ‘surgical’ group was small in comparison with the APLD group, we found no significant difference in the employment rates and outcome scores at the latest review. Furthermore, the SF36 results indicate that the more rapid rehabilitation associated with a percutaneous technique does not influence the longer-term disability associated with degeneration of the lumbar spine.

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REFERENCES


