Outcome of nucleoplasty in patients with radicular pain due to lumbar intervertebral disc herniation

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Abstract

Background: Nucleoplasty (percutaneous lumbar disc decompression) is a minimally invasive procedure that utilizes radiofrequency energy as a treatment for symptomatic lumbar disc herniation, against open microdiscectomy, which would be the mainstay treatment modality. The literature reports a favorable outcome in up to 77% of patients at 6 months. Aim: To evaluate the effectiveness of nucleoplasty in the management of discogenic radicular pain. Materials and Methods: The medical notes of 33 patients, admitted for nucleoplasty between June 2006 and September 2007, were reviewed retrospectively. All had radicular pain, and contained herniated disc as seen on magnetic resonance imaging (MRI) of lumbosacral spine. Patients were followed up at 1 and 3 months post-procedure. The outcome measures employed in this study were satisfaction with symptoms and self-reported improvement. Results: Thirty-three cases were examined (18 males and 15 females). Twenty-seven procedures were performed with no complications and six were abandoned due to anatomical reasons. There were 18 and 15 cases of disc herniation at L5/S1 and L4/5 levels, respectively. Four weeks following the procedure, 13 patients reported improvement in symptoms, and 14 remained symptomatically the same and subsequently had open microdiscectomy. Conclusion: Nucleoplasty has been shown to be a safe and minimal-access procedure. Less than half of our selected cohort of patients reported symptomatic improvement at 1-month follow-up. We no longer offer this procedure to our patients. Possible reasons are discussed.

Key words: Lumbar disc herniation, nucleoplasty, radicular pain

INTRODUCTION

Lumbar disc herniation can cause spinal nerve root compression. The local inflammatory response and the anatomical features of the herniated disc and spinal canal determine the resultant clinical syndrome which may include low back pain, and sciatica with or without neurological deficit. It has been estimated that about 80% of the western population would suffer some back pain in their lifetime. More than half of these would have radicular pain. Ten million people per year are affected in the United States alone, costing roughly around $20 billion, in addition to loss of manpower due the absence from work.

Mainstay of treatment for patients with radicular pain due to lumbar disc herniation involves open lumbar discectomy, and has provided excellent outcome in over six decades. Surgery (discectomy), aims to alleviate pain ahead of the natural history. Almost all patients report significant pain relief in the early post-operative period.

Given the current trend of minimal access surgery which transcends all aspects of surgical practice, nucleoplasty has been described recently as a minimal-access procedure with good outcome. It utilizes coblation technology that dissolves the soft tissue of nucleus pulposus, and therefore causes disc decompression and symptom improvement.

AIM

To evaluate the effectiveness of nucleoplasty in the management of radicular pain due to small lumbar disc herniation.
MATERIALS AND METHODS

The medical notes of patients admitted for nucleoplasty were reviewed retrospectively. Data collected include: Age, gender, presence and duration of radicular symptoms or signs, previous procedures (e.g. epidural injection), the level of disc herniation as seen on magnetic resonance imaging (MRI), and clinical assessment (by the same assessor) pre-procedure and at 1 and 3 months following the procedure.

Clinical inclusion criteria: Radicular symptoms and signs for 6 months or more, and failing to respond to conservative management (e.g. physiotherapy, analgesia, epidural injection, and selective nerve root blocks). Patients involved in legal cases were noted but not excluded. [Table 1]

Radiological inclusion criteria: Single-level, small-size, contained lumbar disc herniation (that is clinically relevant) with neural compression as seen on a lumbosacral spine MRI, preservation of disc trilaminar appearance, preservation of at least 50% of the disc height when compared to adjacent discs. [Table 1]

Exclusion criteria: Previous lumbar disc procedure (surgery, Intradiscal Electrothermal Therapy IDET, nucleoplasty), history of uncontrolled psychological disorder, radiological evidence of annular tear and disc sequestration (i.e. uncontained herniation), multilevel disc herniation, spinal stenosis, other pathologies (e.g. tumor) that explain the clinical presentation.

Nucleoplasty technique

The procedure was performed by the same surgeon as a day case under local anesthesia in prone position. Aseptic technique was strictly adhered to. The nucleoplasty wand was placed percutaneously into the nucleus pulposus under fluoroscopic guidance. All patients underwent discography with contrast medium to assess annular integrity. Annular integrity was confirmed by non-passage of the contrast into the epidural space. The disc was penetrated from the symptomatic side. The surgical probe (Perc-DLE spine wand, Arthrocare Corp. Austin, Texas) was placed into the assess cannula and advanced until the tip of the catheter was approximately 5 mm beyond the tip of the spinal needle, till it came into contact with the annulus on the contralateral side. The process of disc decompression involved advancing the catheter, in ablation mode, at a speed of 0.5 cm/s and withdrawing the wand in coagulation mode at a speed of 0.5 cm/s. A total of six channels were made.

Outcome instrument

Since this was a retrospective study, the outcome measures employed in this study were patient satisfaction with symptoms and self-reported improvement.

RESULTS

Thirty-three patients were enrolled between June 2006 and September 2007. Twenty-seven patients had undergone the procedure with no complications and six procedures were abandoned due to anatomical reasons. The mean age of the 27 patients was 37 years (range 19-83, median 31). There were 16 males and 11 females, with a mean duration of symptoms of 16 months (range 6-72, median 8). At 1-month follow-up, 13 patients reported significant improvement in symptoms, and in 14, the symptoms remained the same. Table 2 summarizes the results.

DISCUSSION

Chronic back pain is fast becoming one of the major debilitating ailments in modern society, with its attendant social and financial consequences. [10]

Initial management for patient with this condition is conservative, by way of analgesia, anti-inflammatory...

Table 1: Inclusion and exclusion criteria

| Clinical | Inclusion | Exclusion |
|----------|-----------|-----------|
| Radicular symptom >6 months | Radicular symptoms <6 months |
| Failure to respond to conservative treatment | Previous lumbar disc surgery |
| | Uncontrolled psychological disorder |
| | Multi-level disc pathology |
| | Annular tear with sequestration |
| | Spinal stenosis |
| Radiological | Single-level disc pathology |
| | Small, contained disc |
| Preservation of disc trilaminar appearance | Other spinal pathologies, e.g. tumor |
| Disc height >50%, compared to adjacent discs |

Table 2: Patient demographics and result

| Level of disc herniation | Improved | Same |
|-------------------------|----------|------|
| L4/5                    | 7        | 8    |
| L5/S1                   | 6        | 6    |
| Gender                  |          |      |
| Male                    | 8        | 8    |
| Female                  | 5        | 6    |
| Duration of symptoms    |          |      |
| <8 months               | 7        | 7    |
| >8 months               | 6        | 7    |
| Age                     |          |      |
| <29 years               | 8        | 3    |
| >29 years               | 5        | 11   |
medications, physiotherapy, and bed rest. Those who do not respond to the above can go a step further to have epidural injections or specific nerve blocks. In most cases, patients improve in a few weeks with these measures, reflecting the natural history of discogenic radicular pain.[11]

In some patients who do not improve with conservative measures or those who present at first contact with large, uncontained disc herniation, surgery by way of open lumbar microdiscectomy is offered and has remained the mainstay for over six decades [Figure 1].

However, in view of the changing trends in surgical practice toward “achieving much, however, doing so little,” the so-called “minimalization,” nucleoplasty has been reported.

It is a minimally invasive technique for treating patients with contained herniated disc (see the technique described above). Several publications have suggested the efficacy of nucleoplasty.

Mirzai et al.[12] reported symptom resolution in 77% of patients at 6 months following nucleoplasty. However, in 40% of patients, the symptoms remained 2 weeks post-procedure. Other studies showed similar results. In this study, 51% of patients remained with the symptoms at 1-month follow-up.

There was no correlation between outcome and the level of disc herniation, gender, or duration of symptoms. The median age of patients who improved following nucleoplasty and of those in whom the symptoms remained was 29 and 35 years, respectively. Eight of the 11 patients (73%) aged 29 years or less improved following the procedure. However, the statistical significance of this finding remains weak due to the small sample size. All, except one, of those who remained symptomatic following nucleoplasty underwent discectomy at a later date and improved at 1-month follow-up thereafter.

We tend to offer surgery to patients with moderate or large herniation with neural compression and when significant symptoms persist beyond 2 months despite conservative management. In patients with small herniation, a conservative approach is adopted for a longer period of time before surgery is considered. As much as 60-80% of patients with radicular pain due to small herniated disc showed remarkable improvement overtime with conservative treatment.[13,14]

In this study, nucleoplasty was offered instead of surgery because of the encouraging reports in the literature.[13] Various clinical and radiological studies have shown that in the majority of patients with symptomatic herniated disc, symptoms and disc herniation subside over a period of time without intervention[13] (surgery or nucleoplasty). The most significant response to intervention occurs in the first month post-intervention. Thereafter, there is no significant difference when compared to the natural history.

CONCLUSION

Although nucleoplasty is a safe minimal-access procedure, it is no longer recommended for this group of patients for two reasons. First, outcome at 1 month is more predictable and a greater proportion of patients improve following surgery than nucleoplasty. Second, at further follow-up, outcome following nucleoplasty is not significantly different than the history or surgery.

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