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Chemonucleolysis and automated percutaneous discectomy – a prospective randomized comparison

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Abstract In this prospective study 22 patients with painful disc herniations were randomized either to chemonucleolysis (CN) or automated percutaneous discectomy (APD). Preoperatively the Oswestry score was 44 points in the CN group and 41 points in the APD group. Except for a longer duration of preoperative leg pain in the APD group, clinical data were *approximately the similar same* in the two groups. In the APD group there was one intra-operative complication. Open revision surgery in the same segment was performed once in the CN group and twice in the APD group. Improvement of neurologic deficits and of Oswestry score was significant in both groups. At 2 years after surgery the CN treated patients were significantly better with respect to Oswestry score, back pain and leg pain recurrence.

Résumé Etude prospective de 22 patients avec hernie discale douloureuse. Randomisation entre un traitement par chimionucléolyse (CN) ou discectomie percutanée (APD). Avant l'intervention, le score d'Oswestry était de 44 points dans le groupe CN et de 41 points dans le groupe APD. A part une plus longue durée d'évolution douloureuse dans le groupe APD, les données cliniques étaient approximativement les mêmes dans les deux groupes. Il y a eu une complication opératoire dans le groupe APD. Une reprise chirurgicale classique fut nécessaire une fois dans le groupe CN, et deux fois dans le groupe APD. L'amélioration du déficit neurologique et du score d'Oswestry fut significative dans les deux groupes. 2 ans après le traitement, les patients traités par chimionucléolyse avaient des résultats significativement meilleurs compte-tenu du score d'Oswestry et de la récurrence de douleurs lombaires ou du membre inférieur.

Introduction

Chemonucleolysis (CN) was described by Smith in 1963 [19,20] and the drug chymodiactin was approved for use by the US Food and Drug Administration (FDA) in 1982 [6]. Although serious complications have been reported, chemonucleolysis is still considered as 'the gold standard' of minimally invasive disc therapy [6,8,18].

As an alternative to chemonucleolysis techniques for operative removal of disc material [5,9,16] have been developed, and early results of automated percutaneous discectomy (APD) were superior to those of manual percutaneous discectomy and of chemonucleolysis [13]. Unfortunately, these good results were not reproduced in widespread use, and at the present time very few prospective randomized studies of minimally invasive procedures are available [14,18].

Materials and methods

Between January 1994 and December 1995, 29 patients were selected for minimally invasive treatment following the criteria of Liebler et al. [12]. The presence of a symptomatic disc lesion was confirmed by discography.

Seven patients had to be excluded from the study as a result of epidural leakage of contrast medium during discography, and all were treated by open surgery. The remaining 22 were randomized to treatment with either CN or APD.

Automated percutaneous discectomy was based on Onik's guidelines [16,17]. Chemonucleolysis was performed with a standard postero-lateral approach using 4000 IÉ chymodiactin. All 22 procedures were performed immediately after positive discography.

Image intensification was used in both CN and APD, and local anesthesia with mild sedation was employed in order to decrease any risk of nerve damage. Patients remained in the hospital for an average of 6 days after the procedure, and clinical and radiological data were recorded after 6 weeks, 12 months and 2 years. Particular emphasis was placed on the presence of any neurological symptoms and on the Oswestry score [4], as well as the findings at routine clinical examination.

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Results

Chemonucleolysis group

Twelve patients (4 women and 8 men) were treated by CN, and their average age was 37 years (range: 24–54 years). Ten patients had a positive Lasegue's sign as well as sensory abnormalities (mainly a deficit), 6 had an average weakness of power 3 or below in a myotome-related muscle, and 3 patients had abnormal reflexes. Back pain had been present for an average of 3 years, and leg pain for 5 months. They had received a minimum of 6 weeks' conservative treatment with at least 1 week in the hospital. Preoperative investigations included plain X-rays in all patients, 6 had a computerized tomography (CT) scan, 4 a magnetic resonance imaging (MRI) scan, and 2 had both. A disc herniation was found at L4/5 in 4 patients, and at L5/S1 in 8. There were no intra-operative complications, but 5 patients experienced back spasm, which started on the day after operation.

At 6 weeks there was significant improvement in neurological deficits ($P<0.01$) and significant improvement in the Oswestry score ($P<0.001$). Back spasms were severe during the first week, but decreased within 4–8 weeks. Follow-up at 12 months did not reveal any further improvements, and in 2 patients mild back pain and leg pain had reappeared after 6 months. However, this did not alter the Oswestry score. One patient developed nerve root symptoms after 3 months, and this necessitated open discectomy, which produced a good result. There was no significant change in clinical parameters, neurological function or Oswestry scores at 2 year follow-up, but 3 patients complained of occasional mild back pain. The average time away from work was 6 weeks, 1 patient retired after surgery, and the 7 patients who had enjoyed sports before their operation were able to return to this within 4–12 weeks.

Automated percutaneous discectomy group

Ten patients underwent APD (2 women and 8 men) and their average age at surgery was 42 years (range: 26–60 years). There were 8 with a positive Lasegue's sign, 7 had a sensory deficit, 5 had motor weakness (average power grade 4), and in one the Achilles tendon reflex had disappeared.

Preoperative back pain had been present for an average of 3 years and leg pain for 11 months. Patients had been admitted for at least 6 weeks of conservative treatment. All were examined by plain radiographs; 6 also had a CT scan, 3 an MRI and 1 a CT, MRI and myelography. In 5 of the patients the disc lesion was at the L4/L5 level, and at L5/S1 in the other 5.

During operation the tip of the "suction punch" fractured in one case and had to be removed at open operation. Another patient required a microdiscectomy 4 weeks after the minimally invasive procedure because of persistent nerve root pain.

Examination 6 weeks after the operation showed a significant improvement in the neurological deficits ($P<0.05$) and the Oswestry scores ($P<0.001$). These results were slightly, but not significantly, better than those following treatment by chemonucleolysis. After 12 months the neurological parameters and the Oswestry scores showed only slight differences. Two patients had mild back pain, but this did not influence their Oswestry scores. However, 2 years after surgery there was a deterioration in the Oswestry score. Recurrence of back and leg pain in 5 produced a significant ($P<0.05$) deterioration when compared both to the earlier assessments and also to the results obtained in the CN group.

Discussion

Any treatment for a disc herniation should produce a better result than that which is likely to occur without intervention [23]. Weber [22] has shown that there is no difference at 4 years between the results of conservative management and those following operation. The major advantage of surgery is evident during the first postoperative year, and both standard discectomy and microdiscectomy give 80–90% of good results [1,21].

However, the occurrence of postoperative syndromes, which are seen in 7–20% of patients after open disc surgery [2,24] has resulted in a search for a reliable and successful minimally invasive technique. Failures of conventional operation are caused by central and lateral spinal stenosis, postoperative adhesive arachnoiditis, epidural scar formation and fibrosis [1]. But fibrosis, scar tissue and adhesions are not only a complication of surgery, as they also occur to some extent after conservative treatment [3]. The avoidance of scar formation and of fibrosis is the major advantage of manual or automated percutaneous techniques. The potential risks of minimally invasive procedures are extraforaminal root lesions and para-spinal bleeding [7], but fortunately these complications are very rare [8]. The major arguments against minimally invasive surgery arise from the current evidence, which suggests that the clinical results are still inferior to those of microdiscectomy [15]. However, there are a few reports of superior results following this technique [10].

Chemonucleolysis had a predictable outcome with 70–80% of good clinical results [8], and despite possible complications (anaphylaxia or transverse myelitis) and uncontrollable enzyme activity, it is an easy and safe and reasonably reliable procedure. In our series the main problem was that 5 patients had back spasm [11] after chemonucleolysis but this fortunately resolved spontaneously.

All the relevant published studies reveal the advantages of chemonucleolysis when compared with other percutaneous techniques [18], and this is confirmed by our findings despite the slight advantages of APD in the early postoperative period. Thus, any further percutaneous techniques that are developed will have to give results that are superior to those produced either by chemonucleolysis or by microdiscectomy.

References

1. Abramovitz J, Neff S (1991) Lumbar disc surgery. *Neurosurgery* 29:301–308
2. Andrews DW, Lavyne MH (1990) Retrospective analysis of microsurgical and standard lumbar discectomy. *Spine* 15:329–335
3. Dellauche-Cavallier MC, Budet C, Laredo JD (1992) Lumbar disc herniation: computed tomography scan changes after conservative treatment of nerve root compression. *Spine* 17:927–933
4. Fairbank JCT, Couper J, Davies JB, O'Brien JP (1980) The Oswestry low back pain disability questionnaire. *Physiotherapy* 66/8:271–273
5. Hijikata S, Yamagishi M, Nakayama T, Oomori K (1975) Percutaneous nucleotomy: a new treatment method for lumbar disc herniation. *J Toden Hosp* 5:5–13
6. Javid MJ (1995) Chemonucleolysis vs laminectomy: a cohort comparison of effectiveness and changes. *Spine* 20:2016–2022
7. Kahanovitz N (1992) Percutaneous discectomy. *Clin Orthop* 284:75–79
8. Kahanovitz N (1994) Chemonucleolysis and percutaneous discectomy procedures. *Curr Opin Orthop* 5 II:69–72
9. Kambin P, Gellman H (1983) Percutaneous lateral discectomy of the lumbar spine. *Clin Orthop* 174:127–131
10. Kambin P, Schaffer JL (1992) Percutaneous discectomy. *Clin Orthop* 284:75–79
11. Kitchel SH, Brown MD (1992) Complications of chemonucleolysis. *Clin Orthop* 284:63–73
12. Liebler WA (1995) Percutaneous laser disc nucleotomy. *Clin Orthop* 310:58–66
13. Maroon JC, Onik G, Vidovich DV (1993) Percutaneous discectomy for lumbar disc herniation. *Neurosurg Clin North Am* 4:125–134
14. Mayer HM, Brock M (1993) Percutaneous endoscopic discectomy. *J Neurosurg* 78:216–225
15. Mayer HM (1994) Percutaneous lumbar disc surgery. *Spine* 19:2719–2723
16. Onik G, Helms C (1985) Percutaneous lumbar discectomy using new aspiration probe. *Am J Radiol* 144:1137–1140
17. Onik G, Maroon J, Davis GW (1989) Automated percutaneous lumbar discectomy at the L5-S1 level. *Clin Orthop* 238:71–76
18. Revel M, Payan C, Vallee C (1993) Automated percutaneous lumbar discectomy versus chemonucleolysis in the treatment of sciatica. *Spine* 18:1–7
19. Smith L (1963) Enzyme dissolution of nucleus pulposus. *Nature* 4887:1311–1312
20. Smith L (1964) Enzyme dissolution of the nucleus pulposus in humans. *JAMA* 187:137–140
21. Striffeler H, Groger U, Ruelen HJ (1991) “Standard” microsurgical lumbar discectomy vs “conservative” microsurgical discectomy. *Acta Neurochir (Wein)* 112:62–64
22. Weber H (1978) Lumbar disc herniation: a prospective study of prognostic factors including a controlled trial. *J Oslo City Hosp* 28:33–61 (Part I), 89–113 (Part II)
23. Weber H (1994) The natural history of disc herniation and the influence of intervention. *Spine* 19:2234–2238
24. Weinstein J, Spratt KF, Lehmann T, Hejna W (1986) Lumbar disc herniation. A comparison of the results of chemonucleolysis and open discectomy after ten years. *J Bone Joint Surg [Br]* 68:43–54