

## **Treatment of Cervicobrachialgia Utilizing Percutaneous Cervical Disc Nucleoplasty : One Year Follow-Up**

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# Abstract

*Objective* Patients suffering from cervicobrachialgia had only the therapeutical solution between conservative treatment and monosegmental spondylodesis or disc prosthesis of the mentioned motion segment. We want to evaluate the effect of a clinically demonstrated innovation “percutaneous cervical disc nucleoplasty” in percutaneous disc decompression.

*Methods* From October 2008 to October 2009, 29 patients with magnetic resonance imaging (MRI) proven contained herniated cervical disc were treated by nucleoplasty with the Perc- DC® Spine Wand (Arthrocare®) on the pathological disc after conservative treatment about on average 3 months. A randomized control group of 29 patients was enrolled within the same criteria with only conservative treatment. With a follow-up time of 1-years we evaluated an average pain reduction by the visual pain score (VAS). The VAS was checked 24 h, 1 week, 3, 6, 12 and 24 months after treatment.

*Results* There were 18 female and 11 male persons with a mean age of 23– 49 years. The mean VAS was 8.8 just before surgical treatment and 2.3 after 1 year follow-up. The mean age of the persons was 26–56 years. The VAS was 8.4 on average just before starting conservative treatment. The distribution of the prolapse to the motion segment of the cervical spine was conservative/surgical group: C4/5 (8 respectively 7 patients), C5/6 (19 respectively 17 patients) and C6/7 (2 respectively 6 patients.) The total number of 29 nucleoplasty were performed (three on two adjacent levels). The C4/5 disc level was treated in eight cases (28%), C5/6 in 19 cases (65%) and C6/7 in two cases (7%) with the Perc-DC® Spine Wand. All patients were immediately mobilized. No complications with this method were seen.

*Conclusion* Percutaneous cervical disc nucleoplasty is a fast and secure treatment for cervicobrachialgia. Furthermore, a diminution after the cervical nucleoplasty which has the optimal results after 1 and 3 months was found.

Keywords : Cervicobrachialgia, Percutaneous cervical disc nucleoplasty, visual pain score

## Introduction

Cervicobrachialgia is disabling and costly and is common in the adult general population.<sup>1-4</sup> The lifetime prevalence of cervicobrachialgia has been reported to be 26% to 71%.<sup>1</sup> Researches on the prevalence of chronic cervicobrachialgia and its impact on health risk showed 14% of patients reporting Grade II to IV cervicobrachialgia with high pain intensity with disability.<sup>2,4,5</sup> Cervicobrachialgia is also associated with significant economic, societal, and health impact like low back pain. Actually, cervicobrachialgia has been well recognized as a source of disability in the white collar population.<sup>6,7</sup> Cervicobrachialgia has also been reported to account for approximately 15% of hospital physiotherapy and 30% of chiropractic visits.<sup>3</sup> Moreover, it may cause absence from work as often as low back pain.<sup>3,6,7</sup> Therefore, it is important to investigate the proper management for cervicobrachialgia in Taiwan.

The management for cervicobrachialgia includes conservative treatment by medication or rehabilitation and invasive techniques by disc decompression. Disc decompression has been shown to treat symptomatic patients with contained herniated discs.<sup>8</sup> Percutaneous disc decompression is based on the principle that a small reduction of volume in a closed hydraulic space, like an intact disc, results in a disproportionately large fall of pressure. A rise in pressure results from a small increase in volume, confirming the biochemical basis for the benefits obtained from interventions designed for disc decompression.<sup>9</sup> There are two less-invasive techniques in percutaneous disc decompression. One is percutaneous cervical discectomy (PCD).<sup>10</sup> It has been developed as an effective treatment option for soft cervical disc herniation. The other is percutaneous nucleoplasty (PCN), which we showed in this study. It is a new minimally invasive technique which uses radiofrequency energy to ablate the nucleus pulposus in a

controlled manner for disc decompression.<sup>10</sup> Disc nucleoplasty allows for controlled removal of a precise amount of tissue by the surgeon.

In our previous study, we found percutaneous nucleoplasty in lumbar spine had minimal damages to the surrounding tissue, minimal thermal penetration with localized effect conducted in a shorter time period, leading to less intra-operative and post-operative pain, allowing for quick rehabilitation.<sup>8</sup> However, to date, the clinical outcomes of cervicobrachialgia utilizing percutaneous nucleoplasty have not been fully evaluated. Therefore, in this retrospective study, we compared the therapeutic effect of percutaneous cervical disc nucleoplasty and conservative treatment by VAS pain scores and functional status in a group of patients with neck pain.

Treatment of discogenic pain usually involves prescription of opioids, non-steroidal anti-inflammatory drugs (NSAIDs) or physical therapy, but they may not be the optimal solution. Opioids may be addictive and patients may build up drug tolerance. NSAIDs have potentially dangerous side-effects, and physical therapy may be ineffective.<sup>8</sup> Though NSAIDs for acute low back pain usually work, the risks and benefits must be closely evaluated when NSAIDs are used in chronic conditions.<sup>8</sup> Moreover, many patients suffering with chronic discogenic pain become refractory to medical management after some time. Minimally invasive techniques should therefore be made available to these patients.

By creating a feasible and secure anatomical pathway between the arteria carotis externa at the lateral border line and the trachea at the medial border line within the antero-lateral approach to the cervical disc allows the surgeon to obtain a secure technique for treating his patients using the coblation technique (Fig.1). Introduction of

large instruments into the nucleus of the disc can create irreversible damages to the annulus and accelerate process of the disc degeneration. Cervical disc nucleoplasty uses a small 19-gauge needle to access the disc and minimizes the damage to the annulus while introducing the wand.

## **Materials and methods**

Subjects were recruited from outpatient clinics in 2007. The study protocol was approved by the Joint Institution Review Board in Taiwan. All study subjects provided informed consents. The major criteria for patients included: 1).Radicular/axial symptoms 2).Arm pain back pain 3).MRI evidence of contained disc protrusion or non-herniated 4).disc prolapse 5).Intensive conservative therapy (physiotherapy, medicaments, injections) for 2–3 months. 6). Failed selective nerve root block Exclusion criteria included: 1).Disc height <50% 2).Evidence of severe disc degeneration 3).Spinal fracture or tumor 4).Moderate/severe spinal stenosis

### **Anatomical pathway**

Cervical nucleoplasty intervention is performed on an outpatient basis under local anaesthesia . Nucleoplasty is performed from an antero-lateral approach. Fluoroscopic imaging is used for the percutaneous placement of a Crawford needle into the nucleus pulposus of the cervical disc. For reaching the cervical disc with the introducer needle is between the arteria carotis externa and the trachea (Fig. 2). The Perc-DC® SpineWand is to be used with specifically modified 19-gauge needle to provide minimally invasive entrance to the intradiscal space.

The introducer needle is advanced into the disc under fluoroscopic guidance. The tip of the needle is placed at the centre of the disc. The device is introduced by pulling back the needle out to some extent; the active tip is positioned in the dorsal third of the cervical disc. The introducer needle is retracted to the medial third of the disc. Then the PercDC-Spine Wand is advanced to the dorsal third of the cervical disc. (Fig.3A).

While treating the cervical disc with the nucleoplasty technique the surgeon should not advance the Perc-DC Spine Wand.

The decompression will be done in coblation mode (level 2 of the controller) by rotating the device through 180° forward and backward. In our experience we have the best results by doing the ablation mode for only 6–8 s in the dorsal, medial and anterior third of the cervical disc. The Coblation® Mode can thereby be used at the tip of the Perc-DC® Spine Wand (Fig. 3B) .X-ray control during the coblation a lateral view of the cervical spine level C3/4.

### **Clinical investigation**

From October 2008 to October 2009, 29 patients with magnetic resonance imaging (MRI) proven contained herniated cervical disc were treated by nucleoplasty with the Perc- DC® Spine Wand (Arthrocare®) on the pathological disc after conservative treatment about on average 3 months ( physiotherapy and nerve root injections). There were 18 female and 11 male persons with a mean age of 23– 49 years.

The mean VAS was 8.3 just before surgical treatment and 2.5 after 1 year follow-up. The mean age of the persons was 26–56 years. The VAS was 8.1 on average just before starting conservative treatment. Inclusion criteria for the nucleoplasty procedure were disc protrusion or contained herniated disc not larger than 4 mm and not compromising more than 1/4 of the central spinal canal demonstrated on a MRI. The distribution of the prolapse to the motion segment of the cervical spine was conservative/surgical group: C4/5 8 respectively 7 patients, C5/6 19 respectively 17 patients and C6/7 2 respectively 6 patients.

In the surgical group (in all 29 patients) three suffered about a persistent cervical



pain and 26 suffered about a dermatome related irradiation which belongs to the height of the cervical disc protrusion or prolapse with arm pain. Preoperatively all patients suffered about a diminution of cervical side bending and side rotation towards the side of cervicobrachialgia. The clinical status was recorded 1 day, 1 week and 1, 3, 6, and 12 months after the procedure. All patients were asked to perform a visual analogue scale (VAS) from preoperative until their last follow-up 24 months later. Three patients in the surgical group get out of sight. Totally 26 patients in the nucleoplasty group could be follow-up after 12 months.

## Results

From October 2008 to October 2009, 29 patients with magnetic resonance imaging (MRI) proven contained herniated cervical disc were treated by nucleoplasty with the Perc- DC® Spine Wand (Arthrocare®) on the pathological disc after conservative treatment about on average 3 months. Another group of 29 patients was enrolled within the same criteria for conservative treatment. There were 18 female and 11 male persons with a mean age of 23– 49 years. The mean VAS was 8.3 just before surgical treatment and 2.5 after 1 year follow-up. The mean age of the persons was 26–56 years. The VAS was 8.1 on average just before starting conservative treatment (Table 1).

### **Distribution of prolapsed motion segments of the cervical spine**

The distribution of the prolapse to the motion segment of the cervical spine was conservative/surgical group: C4/5 (8 respectively 7 )patients, C5/6 (19 respectively 17 patients) and C6/7 (2 respectively 6 patients.) The total number of 29 nucleoplasty were performed (three on two adjacent levels). The C4/5 disc level was treated in eight cases (28%), C5/6 in 19 cases (65%) and C6/7 in two cases (7%) with the Perc-DC® Spine Wand.

### **Clinical Investigations**

In our own investigations with up to 26 patients with a follow- up time of 1 year, we found an average pain reduction with the visual pain score of 2.5 who had a further checkup. The baseline visual pain score (VAS) before the percutaneous cervical decompression by using the nucleoplasty method was 8.3. The total number of 29

nucleoplasty were performed (three on two adjacent levels). The C4/5 disc level was treated in eight cases (28%), C5/6 in 19 cases (65%) and C6/7 in two cases (7%) with the Perc-DC® Spine Wand. The time of surgical intervention differs between 3 and 7 months after first outpatient clinic visit with the author. All patients were immediately mobilized. In the immediate postoperative period after 24 h we had on average a diminution to a VAS on to 5.0 with a low percentage of patients referring amelioration of symptoms.

Already after 1 week postoperatively we found a VAS of 3.3 which ends after 12 months to a VAS of 2.5(**Fig. 4**).

## Discussion

In our own investigations we saw over a long-term period of 12 months a remarkable difference between the conservative treatment and nucleoplasty. We found a fast diminution after the nucleoplasty procedure which has the best results after 1 and 3 months with a VAS of 2.0 and showed afterwards a small deterioration to 2.3 after 12 months. The published clinical results indicate that the nucleoplasty procedure is a promising and efficacious procedure for reducing both axial and radicular symptoms administered in a minimally invasive fashion. However, no long-term data are available. Other minimally invasive intradiscal techniques, as already mentioned in the introduction, have been shown to reduce intradiscal pressure too, but have their limitations.

Our own one-year follow-up with 26 patients showed in the surgical group a persistent pain relief with the VAS from 2.3. Our baseline VAS was 8.8 before the nucleoplasty procedure. By respecting the correct indications concerning contained cervical disc prolapse and after a conservative treatment over 2–3 months the nucleoplasty showed better results than the continuation of conservative treatment. Further investigations with a greater amount of patients and a longer period of observation should be required.

This study has some potential limitations. The retrospective nature of this study is a disadvantage. The sample size is small and results may not be applicable to all patient populations. Our study also has strengths. By using the new coblation technique for the cervical disc nucleoplasty with the easy feasible anatomical pathway between the arteria carotis externa at the lateral border line and the trachea at the medial border line within the antero-lateral approach to the cervical disc the surgeon has a secure technique by the hand for treating his patients.

In conclusion, we found that percutaneous cervical disc nucleoplasty is a quick and safe procedure for cervicobrachialgia. Furthermore, a fast diminution after the nucleoplasty procedure which has the best results after 1 and 3 months was found. Further prospective, randomized, controlled studies are needed to evaluate the long-term efficacy of percutaneous disc decompression and resolution of discogenic pain using cervical nucleoplasty.

## References

1. Hogg-Johnson S, van der Velde G, Carroll LJ, Holm LW, Cassidy JD, Guzman J, Côté P, Haldeman S, Ammendolia C, Carragee E, Hurwitz E, Nordin M, Peloso P, Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. The burden and determinants of neck pain in the general population: Results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. *Spine* 2008; 33:S39-S51.
2. Côté P, Cassidy JD, Carroll L. The Saskatchewan Health and Back Pain Survey. The prevalence of neck pain and related disability in Saskatchewan adults. *Spine* 1998; 23:1689-1698.
3. Peloso PMJ, Gross A, Haines T, Trinh K, Goldsmith CH, Burnie SJ, Cervical Overview Group. Medicinal and injection therapies for mechanical neck disorders. *Cochrane Database Syst Rev* 2007; 3:CD000319.
4. Enthoven P, Skargren E, Oberg B. Clinical course in patients seeking primary care for back or neck pain: A prospective 5-year follow-up of outcome and health care consumption with subgroup analysis. *Spine* 2004; 29:2458-2465.
5. Côté P, Kristman V, Vidmar M, Van Eerd D, Hogg-Johnson S, Beaton D, Smith PM. The prevalence and incidence of work absenteeism involving neck pain: A cohort of Ontario lost-time claimants. *Spine* 2008; 33:S192-S198.
6. Côté P, van der Velde G, Cassidy JD, Carroll LJ, Hogg-Johnson S, Holm LW, Carragee EJ, Haldeman S, Nordin M, Hurwitz EL, Guzman J, Peloso PM, Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. The burden and determinants of neck pain in workers. Results of the Bone and Joint Decade

2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine* 2008; 33:S60-S74.

7. Saskatchewan Workers' Compensation Board. Statistical Supplement 2005.

[www.wcsask.com/WCBPortal/Show-Property/WCBRepository/formsPublications/publications/annualPubs/2005StatisticalSummary//pdfContent](http://www.wcsask.com/WCBPortal/Show-Property/WCBRepository/formsPublications/publications/annualPubs/2005StatisticalSummary//pdfContent).

Accessed date: October 15, 2008.

8. Huan-Chieh Chen, Yu-Ting Tai, I-Jen Wang, Woon-Man Kung, Jia-Wei Lin, Kuo-Sheng Hung, Wen-Ta Chiu, Tien-Jen Lin. Treatment of Chronic Discogenic Pain by Utilizing Both Nucleoplasty and Epidural Neuroplasty — One Year Follow-Up. *Formos J Surg* 2010;43:120-128

9. Case RB, Choy DS, Altman P. Intervertebral disc pressure as a function of fluid volume infused. *J Clin Laser Med Surg*. 1985;13:143–147.

10. Li J, Yan DL, Zhang ZH. Percutaneous cervical nucleoplasty in the treatment of cervical disc herniation. *Eur Spine J*. 2008;17:1664-9. .

11. Nerubay J, Caspi I, Levinkopf M et al (1997) Percutaneous laser nucleolysis of the intervertebral lumbar disc: an experimental study. *Clin Orthop* 337:42–44

12. Ohnmeiss DD, Guyer RD, Hochschuler RH (1994) Laser disc decompression: the importance of proper patient selection. *Spine* 19:2054–2058

13, O'Neill C, Lotz L et al (2004) Percutaneous plasma discectomy stimulates repair in injured porcine intervertebral discs. *Spine J* 4:88– 98

VAS Score	Before	1 D	1W	1 m	3 m	6 m	12 m
Conservative	8.1		7.2	6.2	5.7	5.6	5.3
Nucleoplasty	8.3	5.1	3.3	1.9	2.0	2.6	2.5

**Table 1.** Conservative versus minimal-invasive intervention with nucleoplasty. Comparison over 12 months