Percutaneous Cervical Nucleoplasty in the Treatment of Cervical Disc Herniation, Clinical Results of Neck and Arm Pain

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Objective: *To evaluate the efficacy of percutaneous cervical nucleoplasty in treatment of cervical disc herniation in neck and arm pain.*

Material and Method: *Percutaneous cervical nucleoplasty was performed in 22 patients who had cervical disc herniation between April 2008 and February 2009. The clinical results in terms of clinical outcome were measured by the visual analogue scale (VAS) pain score preoperatively and at 1-week, 1-, 3-, 6-, and 12-month follow-ups.*

Results: *The patient's gender distribution for percutaneous cervical nucleoplasty (PCN) was 10 males and 12 females. The age of the patients ranged from 31 to 55 years, with a mean age of 41 ± 6.8 years. There were no recurrent cases or complications in this study. The mean preoperative neck pain and arm pain were 6.7 ± 1.2 and 8.5 ± 0.7. Whereas, the mean VAS pain scores of neck/arm pain postoperative at 1-week, 1-, 3-, 6-, and 12-month visits were 3.0/2.0, 3.9/1.7, 3.9/1.5, 4.1/2.0, and 3.6/2.1, respectively. There was statistically significant improvement in neck and arm pain after the surgical procedure ($p<0.01$).*

Conclusion: *Percutaneous cervical nucleoplasty in cervical disc herniation resulted in a significance improvement of neck and arm pain in cervical disc herniation.*

Keywords: *Cervical disc herniation, Percutaneous cervical nucleoplasty, Neck pain, Arm pain*

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Cervical disc herniation is a common cause of localized neck and radicular pain (arm pain). Bulging disc material can impinge on a nearby exiting nerve root, compressing it as it enters the neuroforamen and causing pain and potential neurological deficit. Conservative treatment starts with rest, analgesics, non-steroidal anti-inflammatory drugs (NSAIDs) and physical therapy. However conservative treatment has limited success in resolving radiculopathy, with persistent pain and disability in as many as two-thirds of the patients[1,2].When conservative treatment fails, more invasive treatments such as epidural steroid injection, percutaneous cervical nucleoplasty (PCN) and cervical discectomy with or without fusion become appropriate.

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The current trend of all spinal surgery has been toward less-invasive techniques. There are many techniques for decreasing intradiscal pressure such as chemical, mechanical, and thermal/heat methods on both the cervical and lumbar spine[3-7]. One of the minimally invasive spinal surgery techniques is PCN. PCN is an innovative minimally invasive technique used for disc decompression. In order to lower the intradiscal pressure, special devices are inserted percutaneously into the intervertebral discs using radiofrequency energy to ablate the nucleus pulposus. The radiofrequency energy attempts to disintegrate nucleus proteins via energy attained from creation of a plasma field of highly ionized particles. The temperature during the procedure is below 70^{o}C. Because the temperature is low the charring or burning of the surrounding tissues is minimized[8,9]. Jian et al[10] showed significant improvement after PCN in patients with cervical disc herniation with no significant difference in stability. Alessandro et al[11] demonstrated significantly better clinical

outcomes than conservative regimens in patients with contained cervical disc herniation. But to date, no study has been published to demonstrate the difference between axial neck pain and arm pain (radicular pain) from the therapeutic effect of PCN in treatment of contained cervical disc herniation. The aim of this study is to evaluate the clinical results of neck pain and arm pain following PCN treatment of contained cervical disc herniation.

Material and Method

This was a prospective study of 22 consecutive patients including 10 male and 12 female patients with 31 contained cervical disc herniation treated by PCN from April 2008 to February 2009. The patients had to satisfy specific inclusion and exclusion criteria to be enrolled. All patients had a radiographically determined contained disc herniation on MRI. Inclusion criteria were contained disc herniation complaints of neck pain and arm pain and no improvement for at least 6 weeks of conservative treatment (ie, rest, NSAIDs, muscle relaxant and physical therapy). Exclusion criteria were spinal fractures, acquired stenosis, tumor, ossification of posterior longitudinal ligament, previous spinal surgery at the same level, extruded disc fragment, hemorrhagic diathesis and cases of myelopathy.

All patients underwent general anesthesia and were treated by one experienced surgeon. The patients were placed in the supine position. The Perc-DC Spine Wand was used for the nucleoplasty (Fig.1). Fluoroscopic imaging was used during the insertion of the introducer needle and wand placement with antero-posterior and lateral views. The larynx and trachea were displaced medially and the carotid artery laterally. The anterior cervical spine was palpated with the fingertips, and the spinal needle was passed into the disc space. The wand was advanced until its tip reached approximately 3 mm anterior to the posterior edge of the annulus to avoid thermal injury to the neural structure posterior to the annulus. Then the position of the needle was confirmed under fluoroscopy. Short initial coagulation was performed when the wand was inserted. The ablation used two cycles of rotating the tip of the wand 360 degrees (2 seconds for each 60 degrees). Then the position of the wand was changed to the middle of the disc space and ablation was performed again (Fig.2).

The patients were discharged 24 hours later with instructions for follow-up visits. The clinical outcomes were measured by using the visual analog scale (VAS) pain score separately for axial neck pain and arm pain preoperative and postoperative at 1-week and at 1-, 3-, 6- and 12-months. Changes in outcome measurement were evaluated using the Student's paired t-test for coupled data. The statistical analysis was performed using the SPSS program (version 13.0).

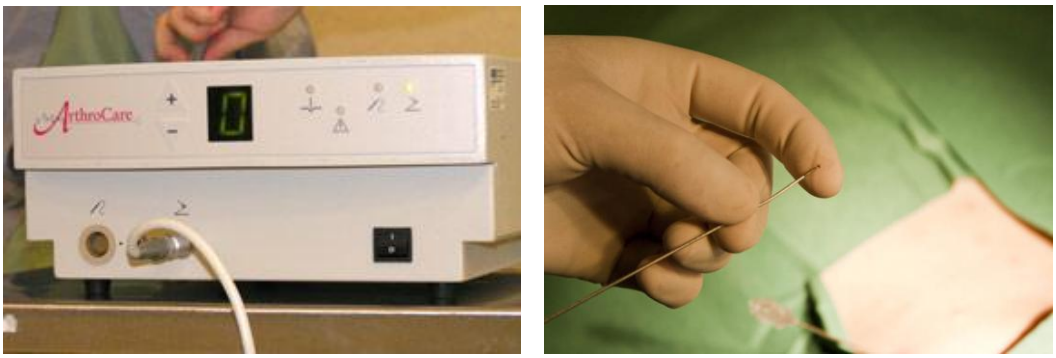

Fig.1 Radiofrequency generator and Perc-DC Spine Wand

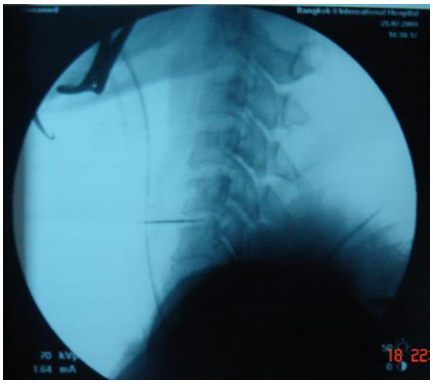

Fig.2 Percutaneous cervical nucleoplasty at C5-6 disc

Results

There were 22 consecutive patients enrolled in this study including 10 males and 12 females with 31 contained cervical disc herniations. The mean age was 41 ± 6.8. Thirteen patients underwent surgery at two levels and nine patients at one level (C4/5 38%, C5/6 41%, C6/7 19%). All patients received follow-ups. No complications were observed. The pre-procedure and post-procedure VAS scores of axial neck pain and arm pain are illustrated in Table 1.

Table 1 Outcomes of percutaneous cervical nucleoplasty in axial neck and arm pain

	Neck pain		Arm pain	
	VAS scores	**p-value**	**VAS scores**	**p-value**
Pre-procedure	6.7 ± 1.2		8.5 ± 0.7	
Post-procedure				
1-week visit	3.3 ± 1.9	< 0.01	2.0 ± 0.8	< 0.01
1-month visit	3.9 ± 1.9	< 0.01	1.7 ± 0.9	< 0.01
3-month visit	3.9 ± 2.0	< 0.01	1.5 ± 0.7	< 0.01
6-month visit	4.1 ± 1.7	< 0.01	2.0 ± 1.2	< 0.01
12-month visit	3.6 ± 1.6	< 0.01	2.1 ± 1.2	< 0.01

The VAS scores of axial neck pain and arm pain demonstrated statistically significant improvement in percutaneous cervical nucleoplasty at 1-week, 1, 3, 6 and 12-month follow-up visits when compare to the pre-procedure scores. The percentage of pain reduction of neck pain were 50%, 41%, 41%, 38% and 45% at 1-week, 1, 3, 6 and 12-months, respectively (mean 43%). The percentage of pain reduction of arm pain are 76%, 79%, 81%, 76% and 73% at 1-week, 1, 3, 6 and 12-months, respectively (mean 77%) (Fig.3).

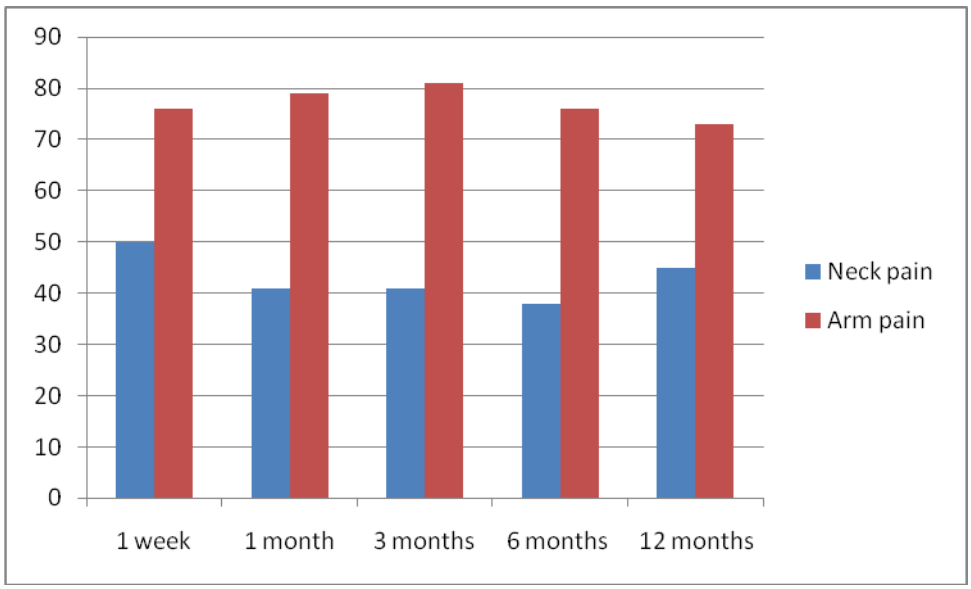

Fig. 3 Percentage of pain reduction compared to pre-procedure

Discussion

Patients with cervical disc herniation respond less often to conservative treatment than lumbar disc herniation because disc herniation spontaneous regression occurs less often in cervical disc herniation than in lumbar disc herniation[12]. Contained disc herniation with intact annulus is usually more problematic than the non-contained type because of a lower potential to initiate natural immune and vascular responses. Annular tears permit infiltration of nucleus pulposus into the epidural space. Autolysis of the proteoglycans chains ensues and the lost hydrophilic potential will ultimately lead to dehydration, shrinkage and regression of the herniated disc[13].

Open surgery is indicated for patients with cervical disc herniations who do not respond to conservative treatment for more than 6 weeks.[14,15]. Anterior cervical discectomy (ACD) without fusion is generally avoided due to the risk of disc space

collapse resulting in cervical kyphosis and leading to axial neck pain and the potential compromising of the neural foramen leading to post-operative radicular pain[16]. Although anterior cervical discectomy with fusion (ACDF) has become the surgical standard for cervical disc herniations[17], it has a morbidity rate as high as 19.3%[18] and potential for complications[19,20,21]. The current trend is toward minimally invasive technology such as plasma disc decompression to avoid ACD complications.

Plasma disc decompression has been used with promising results for a number of years in the lumbar region[22,23,24,25], but is less studied in the cervical spine[8,26,27]. Previous studies showed the efficacy of the nucleoplasty in the treatment of cervical disc herniation[10,11,26,27]. But no study has discussed the differentiation between arm pain and neck pain reduction after cervical nucleoplasty. This study has comfirmed that cervical nucleoplasty is effective in reducing both arm pain and neck pain in short-term results. When compared to the percentage of pain reduction, arm pain reduction (mean 77%) has a greater percentage of pain reduction than neck pain reduction (mean 43%). Axial neck pain is caused from various origins such as facet joints, disc material and neck muscles, whereas the radicular pain (arm pain) is caused from nerve root compression. Cervical nucleoplasty is a disc decompression procedure using the radiofrequecy technique. After the disc material is decompressed it will directly affect the pressure on the nerve root, thereby relieving the arm pain better than the neck pain. In addition, the nucleoplasty can also improve neck pain from discogenic origins, by diminished disc pressure that may otherwise destroy the nerve endings within the disc.

However patient selection is the critical point. Chen et al[28] showed that the intradiscal pressure was markedly reduced in a younger disc cadaver with nucleoplasty as compared with a degenerative disc. In this study the mean age of patients was 41 years which included only soft disc herniations so that may affect the better outcomes. A degenerated disc with narrowing disc space is absolutely not an indication for nucleoplasty. We experienced no complications when treating patients with cervical nucleoplasty and no recurrent cases at the 1-year follow-up. Cervical nucleoplasty seems to have a low complication rate compared to open surgery and has good outcomes on arm pain and neck pain in short term follow-ups. However, long term follow-ups are needed to confirm the clinical results of cervical nucleoplasty in the treatment of cervical disc herniation.

References

1. Dillin W, Booth R, Cuckler J, Balderston R, Simeone F, Rothman R. Cervical radiculopathy (review) Spine 1986; 11(10): 988–91.
2. Lee F, Turner JW. Natural history and prognosis of cervical spondylosis. Br Med J 1963; 2(5373): 1607–10.
3. Dabezies EJ, Langford K, Morris J, Shields CB, Wilkinson HA. Safety and efficacy of chymopapain in the treatment of sciatica due to herniated nucleus pulposus – results of a randomized double-blind study. Spine 1988;13(5): 561-5.
4. Fraser RD. Chymopapain for the treatment of intervertebral disc herniation. A preliminary report of a double-blind study. Spine (Phila Pa 1976) 1982; 7(6): 608–12.
5. Nerubay J, Caspi I, Levinkopf M, et al. Percutaneous laser nucleolysis of the intervertebral lumbar disc: an experimental study. Clin Orthop Relat Res 1997; (337): 42-4.
6. Sasaki M, Takahashi T, Miyahara K, Hirose T.Effects of chondroitinase ABC on intradiscal pressure in sheep: An in vivo study. Spine 2001; 26: 463–8.
7. Smith LW. Enzyme dissolution of the nucleus pulposus in humans. Clin Orthop Rel Res 1986; 206: 4–9.
8. Boswell MV, Trescot AM, Datta S, Schultz DM, Hansen HC, Abdi S, et al. Interventional technique: evidence-based practice guidelines in the management of chronic spinal pain. Pain Physician 2007; 10(1): 7-11.
9. Lee MS, Cooper G, Lutz GE, Doty SB. Histological characterization of coblation nucleoplasty performed on sheep intervertebral discs. Pain Physician 2003; 6(4): 439-42.
10. Li J, Yan DL, Zhang ZH. Percutaneous cervical nucleoplasty in the treatment of cervical disc herniation. Eur Spine J 2008; 17(12): 1664-9.
11. Alessandro C, Pier VN. Plasma disc decompression for contained cervical disc herniation: a randomized, controlled trial. Eur Spine J 2010; 19: 477-86
12. Kobayashi N, Asamoto S, Doi H, Ikeda Y, Matusmoto K. Spontaneous regression of herniated cervical disc. Spine J 2003; 3(2): 230-4.
13. Bush K, Chaudhuri R, Hiller S, Penny J. The pathomorphologic changes that accompany the resolution of cervical radiculopathy. A prospective study with repeat magnetic resonance imaging. Spine 1997; 22(2): 183-6.
14. Hauerberg J, Kosteljanetz M, Boge-Rasmussen T, Dons K, Gideon P, Springborg JB, Wagner A. Anterior cervical discectomy with or without fusion with ray titanium cage: a prospective randomized clinical study. Spine 2008; 33(5): 458-64.
15. Nowakowski A, Kubaszewski L, Kaczmarczyk J. Management of pain syndromes related to cervical herniated disc. Chir Narzadow Ruchu Ortop Pol 2007; 72(2): 85-8.
16. Haden N, Latimer M, Seeley HM, Laing RJ. Loss of intervertebral disc height after anterior

cervical discectomy. Br J Neurosurg 2005; 19(6): 469-74.
17. Tewarie RDSN, Bartels RHMA, Peul WC. Long-term outcome after anterior cervical discectomy without fusion. Eur Spine J 2007; 16(9): 1411-6.
18. Fountas KN, Kapsalaki EZ, Nikolakakos LG, Smisson HF, Johnston KW, Grigorian AA, et al. Anterior cervical discectomy and fusion associated complications. Spine 2007; 32(21): 2310-7.
19. Bertalanffy H, Eggert HR. Complications of anterior cervical discectomy without fusion in 450 consecutive patients. Acta Neurochir (Wien) 1989; 99(1-2): 41-50.
20. Fielding JW. Complications of anterior cervical disk removal and fusion. Clin Orthop Relat Res 1992; 284: 10-3.
21. Flynn TB. Neurologic complications of anterior cervical interbody fusion. Spine 1992; 7(6): 536-9.
22. Gerszten PC, Welch WC, King JT. Quality of life assessment in patients undergoing nucleoplasty-based percutaneous discectomy. J Neurosurg Spine 2006; 4(1): 36-42.
23. Masala S, Massari F, Fabiano S, Ursone A, Fiori R, Pastore F, et al. Nucleoplasty in treatment of lumbar diskogenic back pain: one year follow-up. Cardiovasc Intervent Radiol 2007; 30(3): 426-32.
24. Mirzai H, Tekin I, Yaman O, Bursali A. The results of nucleoplasty in patients with lumbar herniated disc: a prospective clinical study of 52 consecutive patients. Spine J 2007; 7(1): 88-92.
25. Sharps LS, Isacc Z. Percutaneous disc decompression using nucleoplasty. Pain Physician 2002; 5(2): 121-6.
26. Nardi PV, Cabezas D, Cesaroni A. Percutaneous cervical nucleoplasty using coblation technology. Clinical results in fifty consecutive cases. Acta Neurochir Suppl 2005; 92: 73-8.
27. Singh V. Percutaneous disc decompression for the treatment of chronic atypical cervical discogenic pain. Pain physician 2004; 7: 115-8.
28. Chen YC, Sang-Heon L, Chen D. Intradiscal pressure study of percutaneous disc decompression with nucleoplasty in human cadavers. Spine 2003; 28(7): 661-5.

ผลของการรักษาโรคหมอนรองกระดูกคอเคลื่อนโดยวิธีนิวคลีโอพลาสทีในด้านลดอาการปวดคอและอาการปวดแขน

กู้พงษ์ ศิริบำรุงวงศ์, พบ, ทวีชัย เตชะพงศ์วรชัย, พบ

บทนำ: *โรคหมอนรองกระดูกคอเคลื่อนเป็น โรคที่พบได้บ่อย การรักษาโดยวิธีนิวคลีโอพลาสทีซึ่งเป็นการใช้คลื่นความถี่วิทยุจี้ไปในหมอนรองกระดูกสันหลัง เป็นการรักษาที่มีประสิทธิผล แต่ยังไม่มีการศึกษาถึงผลของการรักษาในด้านอาการปวดต้นคอ และอาการปวดแขน*

วัตถุประสงค์: *การศึกษาเพื่อที่จะประเมินประสิทธิผลของการรักษาผู้ป่วยหมอนรองกระดูกคอเคลื่อนด้วยวิธีนิวคลีโอพลาสทีทั้งในเรื่องของอาการปวดแขน และอาการปวดต้นคอ*

วัสดุและวิธีการ: *คณะฯ ได้ทำการรักษาผู้ป่วยหมอนรองกระดูกคอเคลื่อนทั้งหมด 22 รายด้วยวิธีนิวคลีโอพลาสที โดยเริ่มตั้งแต่ เมษายน 2551 ถึง กุมภาพันธ์ 2552 โดยทำการรักษาเฉพาะผู้ป่วยกลุ่มที่หมอนรองกระดูกคอเคลื่อนแต่ยังไม่แตกและทำการประเมินผลของการรักษาในเรื่องของอาการปวดต้นคอและอาการปวดร้าวแขนก่อนรักษาและ 1 สัปดาห์ 1,3,6,12 เดือนหลังได้รับการรักษาโดยนิวคลีโอพลาสที*

ผลการศึกษา: *คณะฯ ได้ทำการศึกษาผู้ป่วยทั้งหมด 22 รายแบ่งเป็นผู้ชาย 10 ราย ผู้หญิง 12 ราย อายุอยู่ในช่วง 31 ถึง 55 ปี อายุเฉลี่ย 41 ปี จากการศึกษาพบว่า ไม่พบการกลับเป็นซ้ำและภาวะแทรกซ้อน ค่าเฉลี่ยอาการปวดต้นคอและอาการปวดร้าวแขนก่อนผ่าตัดคือ 6.7±1.2 และ 8.5±0.7ตามลำดับค่าเฉลี่ยอาการปวดต้นคอหลังการรักษาที่1 สัปดาห์ 1,3,6,12 เดือนคือ 3.3,3.9,3.9,4.1,3.6 ตามลำดับค่าเฉลี่ยอาการปวดร้าวแขนหลังการรักษาที่1 สัปดาห์ 1,3,6,12 เดือนคือ 2.0,1.7,1.5, 2.0, 2.1 ตามลำดับ จากการศึกษาพบว่าอาการปวดคอและปวดร้าวมาแขนลดลงอย่างมีนัยสำคัญทางสถิติหลังจากการรักษาโดยนิวคลีโอพลาสทีที่1 สัปดาห์ 1,3,6,12 เดือนเมื่อเทียบกับอาการปวดคอและอาการปวดร้าวแขนก่อนรักษา*

สรุป: *การศึกษาของคณะฯยืนยันว่าการรักษาผู้ป่วยหมอนรองกระดูกคอเคลื่อนด้วยนิวคลีโอพลาสทีให้ผลการรักษาที่ดีในการลดอาการปวดคอและอาการปวดร้าวแขน ขณะที่อาการปวดร้าวแขนจะได้ผลการรักษาที่ดีกว่าอาการปวดคอ*