

Clinical Article

Computed Tomography Fluoroscopy-Guided Selective Nerve Root Block for Acute Cervical Disc Herniation

Sang Soo Eun, M.D.,¹ Won Sok Chang, M.D.,² Sang Jin Bae, M.D.,³ Sang-Ho Lee, M.D., Ph.D.,⁴ Dong Yeob Lee, M.D.⁴

Departments of Orthopedic Surgery,¹ Anesthesiology and Pain Medicine,² Radiology,³ Neurosurgery,⁴ Wooridul Spine Hospital, Seoul, Korea

Objective : To analyze the clinical outcomes of computed tomography (CT) fluoroscopy-guided selective nerve root block (SNRB) for severe arm pain caused by acute cervical disc herniation.

Methods : The authors analyzed the data obtained from 25 consecutive patients who underwent CT fluoroscopy-guided SNRB for severe arm pain, i.e., a visual analogue scale (VAS) score of 8 points or more, caused by acute soft cervical disc herniation. Patients with chronic arm pain, motor weakness, and/or hard disc herniation were excluded.

Results : The series comprised 19 men and 6 women whose mean age was 48.1 years (range 35-72 years). The mean symptom duration was 17.5 days (range 4-56 days) and the treated level was at C5-6 in 13 patients, C6-7 in 9, and both C5-6 and C6-7 in 3. Twenty-three patients underwent SNRB in 1 session and 2 underwent the procedure in 2 sessions. No complications related to the procedures occurred. At a mean follow-up duration of 11.5 months (range 6-22 months), the mean VAS score and NDI significantly improved from 9 and 58.2 to 3.4 and 28.1, respectively. Eighteen out of 25 patients (72%) showed successful clinical results. Seven patients (28%) did not improve after the procedure, and 5 of these 7 underwent subsequent anterior cervical discectomy and fusion.

Conclusion : CT fluoroscopy-guided SNRB may play a role as a primary conservative treatment for severe arm pain caused by acute cervical disc herniation.

KEY WORDS : Cervical vertebrae · Intervertebral disc · Nerve block.

INTRODUCTION

Cervical radicular pain, which is usually caused by cervical disc herniation, is a common condition³. The natural history of cervical radiculopathy is usually favorable. However, some patients with acute cervical disc herniation may suffer from severe arm pain, which is unresponsive to conservative treatments such as oral analgesics and/or physical therapy. In these situations, patients usually require surgical treatment. Because of the well-known drawbacks of anterior cervical spinal surgery, such as perioperative complications, limitation of range of motion, and/or adjacent segment degeneration^{7,9}, selective nerve root block (SNRB) has played an important role as a conservative treatment for cervical disc herniation. The clinical

results of SNRB for cervical disc herniation have been reported to be favorable^{3,5,11,12}.

The question that remains is whether SNRB would work in patients with very severe arm pain, i.e., a visual analogue scale (VAS) score of 8 points or more, caused by acute cervical disc herniation. Surgeons usually recommend urgent surgical intervention for these patients, since they do not usually respond well to any conservative treatments. However, reports focusing on the clinical outcomes of SNRB for severe arm pain due to acute cervical disc herniation are limited.

In the present study, we analyzed the clinical outcomes of 25 consecutive patients who underwent computed tomography (CT) fluoroscopy-guided SNRB for severe arm pain caused by acute cervical disc herniation.

MATERIALS AND METHODS

The authors retrospectively analyzed the data obtained from 25 consecutive patients who underwent CT fluoroscopy-guided SNRB for severe arm pain caused by acute cervical

• Received : June 23, 2010 • Revised : August 31, 2010

• Accepted : November 26, 2010

• Address for reprints : Dong Yeob Lee, M.D.

Department of Neurosurgery, Wooridul Spine Hospital, 47-4 Cheongdam-dong, Gangnam-gu, Seoul 135-100, Korea

Tel : +82-2-513-8150, Fax : +82-2-513-8146

E-mail : shlee@wooridul.co.kr

disc herniation from May 2008 through September 2009. The inclusion criteria were as follows : 1) soft cervical disc herniation was demonstrated on the CT scan and/or magnetic resonance imaging (MRI); 2) the patients exhibited severe arm pain, i.e., a VAS score of 8 points or more that was consistent with the radiologic findings; and 3) the disc herniation was considered acute when the symptom duration was less than 8 weeks. Patients with chronic arm pain, motor weakness, myelopathy, and/or hard disc herniation were excluded from this review.

A neurosurgeon performed a primary evaluation of the patients including history taking, and neurological and radiological examinations. When a patient with acute cervical disc herniation met the inclusion criteria, the patient was referred to 1 of 2 highly experienced pain management doctors who were engaged in the full-time practice of spinal injections. The doctors performed a CT fluoroscopy-assisted cervical transforaminal injection of steroid. This technique was recently described in detail by Kim et al.¹¹⁾ CT images were obtained to ensure a safe pathway posterior to the anterior scalene, carotid artery, and internal jugular vein targeting the anterior to superior articular process. As a 23 G spinal needle was advanced, a multi-slice CT fluoroscopy image was taken by foot pedal. For confirmation, 0.2 mL of contrast media was first injected, and then 1 mL of a 0.375% lidocaine solution containing 20 mg of triamcinolone was injected (Fig. 1).

Pain was measured before and after the procedure, using the 10-point VAS, and functional status was assessed using the Neck Disability Index (NDI)¹⁷⁾. Clinical success was defined as a > 4 points improvement in the VAS score, > 25% improvement in the NDI score, no major complications related to the procedure, and no requirement for subsequent cervical spinal surgery. Complications were categorized using the classification scheme described by Carreon et al.⁴⁾, which

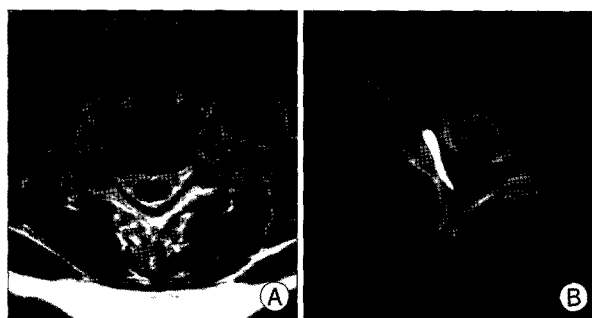


Fig. 1. A 51-year-old female had been suffering from severe right arm pain for 1 month. The axial T2-weighted magnetic resonance image (A) shows disc herniation at the C6-7 level on the right side. A bone set image from CT fluoroscopy at the C6-7 level (B) shows a well-placed needle and injected contrast media inside the foramen and posterolateral epidural space. The needle is kept safely away from the carotid artery, internal jugular vein, and vertebral artery. The head is turned to the contralateral side.

divides them into major and minor complications. Major complications were those that had a negative effect on a patient's recovery, whereas minor complications were those that did not affect recovery significantly. All patients were followed up at the neurosurgeon's outpatient clinic at 3 weeks after the procedure and asked to rate their response to the injection as 'markedly improved', 'improved but still with residual arm pain', or 'not improved at all'. Any problems related to the procedure were recorded at this time. A trained nurse collected the final follow-up data in March 2010 by telephone interview. Statistical analysis was performed using a paired sample t-test and a *p* value of less than 0.05 was considered significant.

RESULTS

The series comprised 19 men and 6 women whose mean age was 48.1 years (range 35-72 years). The mean symptom duration was 17.5 days (range 4-56 days). The treated level was at C5-6 in 13 patients, C6-7 in 9, and both C5-6 and C6-7 in 3. Twenty-three patients underwent SNRB in 1 session and 2 underwent the procedure in 2 sessions. There were no complications related to the procedures.

At a mean follow-up duration of 11.5 months (range 6-22 months), the mean VAS score and NDI significantly improved from 9 and 58.2 to 3.4 and 28.1 respectively (*p* < 0.001). At 3 weeks after the procedure, 16 out of 25 patients showed a marked improvement of arm pain. Two out of 25 patients had improved, but still had residual arm pain. Therefore, these 2 patients underwent CT fluoroscopy-guided SNRB one more time and showed a marked improvement of arm pain after the second procedure. All of these 18 patients (72%) showed the following successful clinical results at the final follow-up : significant improvements in arm pain (a VAS score from 9.2 to 1.6, *p* < 0.001), functional status (an NDI score from 63.4% to 20.9%, *p* < 0.001), and no requirement for cervical spinal surgery. None of these 18 patients experienced recurrence of arm pain during the follow-up period. Seven patients (28%) did not improve at all after the procedure, and 5 of these 7 underwent subsequent anterior cervical discectomy and fusion within 2 week of the initial procedure. Two of these 7 patients refused to undergo cervical spinal surgery. They undertook conservative treatment, such as oral analgesics, herbal medication and/or acupuncture at other hospitals (Table 1).

DISCUSSION

SNRB is performed as a conservative treatment modality for cervical radiculopathy. The clinical outcomes of thera-

Table 1. Demographics and clinical results

No	Sex	Age	Sx duration	Level (days)	Side	Block number	Initial VAS	Initial NDI	Final VAS	Final NDI	Surgery
1	M	49	28	C67	L	1	8	56	8	56	Y
2	M	39	14	C67	L	1	9	55	1	18.3	N
3	M	54	42	C67	R	1	9	56	9	56	Y
4	M	53	5	C56	L	1	9	60	0	16.7	N
5	M	40	10	C56	R	1	8	46.3	6	40	N
6	M	54	14	C56, 67	L	1	10	30	8	30	Y
7	M	46	5	C56	R	1	10	63.3	2	18.3	N
8	F	50	56	C67	L	1	8	35	8	31.7	N
9	M	48	5	C56	L	1	9	60	9	60	Y
10	M	37	56	C67	L	1	8	50	2	18.3	N
11	M	35	14	C56	L	2	8	45	2	20	N
12	F	36	7	C67	L	1	9	60	1	16.7	N
13	F	51	30	C67	R	2	10	70	1	18.3	N
14	M	50	14	C56	L	1	8	55	1	18.3	N
15	M	53	7	C56	L	1	10	66.7	1	16.7	N
16	M	72	14	C56, 67	L	1	9	66.7	1	20.4	N
17	M	52	7	C56	R	1	9	70	1	18.3	N
18	M	57	4	C56	R	1	10	65	2	33.3	N
19	F	42	7	C56	R	1	10	78.3	1	18.3	N
20	M	49	42	C67	L	1	10	64	10	64	Y
21	F	48	8	C56, 67	R	1	10	78.3	1	18.3	N
22	M	52	20	C56	L	1	10	78.3	1	23.3	N
23	M	42	21	C56	L	1	10	68.3	5	28.3	N
24	M	52	4	C67	R	1	9	66.7	3	30	N
25	F	41	4	C56	R	1	10	80	3	18.3	N

F : female, M : male, NDI : Neck Disability Index, ODI : Oswestry Disability Index, Sx : symptom, VAS : visual analogue scale

peutic SNRB for cervical radiculopathy have been reported to be favorable. Bush and Hillier³⁾ injected corticosteroids in 68 patients with cervical radiculopathy, all of whom were potential candidates for cervical spinal surgery. After serial (an average of 2.5) injections using fluoroscopy-guided periradicular and epidural injection techniques, all patients recovered satisfactorily, without the need for surgical intervention. Slipman et al.¹⁶⁾ reported good or excellent results in 60% of the patients after therapeutic SNRB for patients with atraumatic cervical spondylotic radicular pain, who had failed to improve with non-invasive measures. In the present study, all patients enrolled were candidates for cervical spinal surgery and 72% showed improvement of arm pain 3 weeks after the procedure.

One of the concerns about SNRB is the durability of the treatment effect. Berger et al.²⁾ treated 18 patients with cervical radiculopathy by CT-guided foraminal injections and reported effective ($\geq 50\%$) long-term pain relief in 11 out of 18 patients (61.1%). Cyteval et al.⁶⁾ reported good long-term pain relief in 60% of patients at 6 months. However, in a study by Razzaq et al.¹³⁾, who defined long-term pain relief as a decrease of more than 4 points on the VAS at 6 months after the procedure, 57% of the patients had no long lasting

pain relief from SNRB. They, therefore, concluded that SNRB had limited efficacy for the definitive treatment of nerve root pain, but may lead to significant short-term relief, in a subgroup of patients. However, it should be considered that they performed SNRB under the guidance of fluoroscopy only. In the present study, 72% of the total patients improved 3 weeks after the procedure and all of them showed successful results at the final follow-up. The results of the present study show that CT fluoroscopy-guided SNRB may lead to significant short-term and long-term pain relief and is efficacious for acute cervical radiculopathy caused by soft disc herniation. The good results of the present study may be attributable to the narrow inclusion criteria, i.e., acute soft cervical disc herniation, as well as the use of the multislice CT fluoroscopy-guided technique. Compared with SNRB using fluoroscopy only, SNRB using the multislice CT fluoroscopy-guided technique enables a more precise placement of injectate close to the disc-nerve root interface and near the dorsal root ganglia, maximizing the therapeutic effect in terms of both short- and long term pain relief¹¹⁾. However, it should be considered that not all patients with acute cervical disc herniation improve with CT fluoroscopy-guided SNRB. In the present study, 20% of the

patients underwent subsequent cervical spinal. However, SNRB can be used as a diagnostic modality. Diagnostic SNRB can discern the presence or absence of cervical pathologies that cause radiculopathy. In cases where the MRI findings are equivocal, multilevel, and/or do not match with the clinical symptoms, SNRB can be useful for decision-making. Positive SNRB results are known to be associated with good surgical outcomes¹⁵.

The complication rate after SNRB using fluoroscopy only for cervical radiculopathy is reported to be low. However, vascular and neural complications may occur during this procedure, which may result in, although rare, spinal cord infraction, quadriplegia, and even death^{1,8,10,14}. Therefore, the effort to minimize any chance of complications is of the utmost importance during SNRB. Unlike SNRB using fluoroscopy only, one can identify the major cervical vessels and other important anatomical structures on a CT axial view with superior anatomic resolution using the multislice CT fluoroscopy-guided technique. One can therefore place the needle more safely and precisely for injection without any complications compared with SNRB using fluoroscopy only. Kim et al.¹¹ reported no serious complications with this technique and our results confirm this finding, as there were no complications either during or after the procedure in the cases we analyzed.

There are several limitations to this study. It was retrospective, and there was no control group with which outcomes may be compared. Furthermore, the sample size was relatively small. The follow-up data collection took place at an average of 11.5 months after treatment, but the follow-up time varied from 6 to 22 months. Despite these limitations, this study demonstrates the efficacy and durability of CT fluoroscopy-guided SNRB for patients with severe radicular pain caused by acute soft cervical disc herniation.

CONCLUSION

A considerable number of patients suffering from severe arm pain caused by acute cervical disc herniation could be helped by CT fluoroscopy-guided SNRB. This would also avoid the need for cervical spinal surgery. Thus, CT fluoroscopy-guided SCRB can be considered as a useful conservative treatment option for severe arm pain caused by acute soft cervical disc herniation.

• Acknowledgements

This study was supported by a grant from the Wooridul Spine Foundation.

References

1. Baker R, Dreyfuss P, Mercer S, Bogduk N : Cervical transforaminal injection of corticosteroids into a radicular artery : a possible mechanism for spinal cord injury. *Pain* 103 : 211-215, 2003
2. Berger O, Dousset V, Delmer O, Pointillart V, Vital JM, Caillé JM : [Evaluation of the efficacy of foraminal infusions of corticosteroids guided by computed tomography in the treatment of radicular pain by foraminal injection]. *J Radiol* 80 : 917-925, 1999
3. Bush K, Hillier S : Outcome of cervical radiculopathy treated with perineural/epidural corticosteroid injections : a prospective study with independent clinical review. *Eur Spine J* 5 : 319-325, 1996
4. Carreon LY, Puno RM, Dimar JR 2nd, Glassman SD, Johnson JR : Perioperative complications of posterior lumbar decompression and arthrodesis in older adults. *J Bone Joint Surg (Am)* 85-A : 2089-2092, 2003
5. Cluff R, Mehio AK, Cohen SP, Chang Y, Sang CN, Stojanovic MP : The technical aspects of epidural steroid injections : a national survey. *Anesth Analg* 95 : 403-408, 2002
6. Cyteval C, Thomas E, Decoux E, Sarrabere MP, Cottin A, Blotman F, et al. : Cervical radiculopathy : open study on percutaneous periradicular foraminal steroid infiltration performed under CT control in 30 patients. *Am J Neuroradiol* 25 : 441-445, 2004
7. Fessler RG, Khoo LR : Minimally invasive cervical microendoscopic foraminotomy : an initial clinical experience. *Neurosurgery* 51 (Suppl 2) : S37-S45, 2002
8. Furman MB, Giovanniello MT, O'Brien EM : Incidence of intravascular penetration in transforaminal cervical epidural steroid injections. *Spine (Phila Pa 1976)* 28 : 21-25, 2003
9. Hilibrand, Carlson GD, Palumbo MA, Jones PK, Bohlman HH : Radiculopathy and myelopathy at segments adjacent to the site of a previous anterior cervical arthrodesis. *J Bone Joint Surg Am* 81 : 519-528, 1999
10. Karasek M, Bogduk N : Temporary neurologic deficit after cervical transforaminal injection of local anesthetic. *Pain Med* 5 : 202-205, 2004
11. Kim H, Lee SH, Kim MH : Multislice CT fluoroscopy-assisted cervical transforaminal injection of steroids : technical note. *J Spinal Disord Tech* 20 : 456-461, 2007
12. Ma DJ, Gilula LA, Riew KD : Complications of fluoroscopically guided extraforaminal cervical nerve blocks. An analysis of 1036 injections. *J Bone Joint Surg Am* 87 : 1025-1030, 2005
13. Razaq AA, O'Brien D, Mathew B, Bartlett R, Taylor D : Efficacy and durability of fluoroscopically guided cervical nerve root block. *Br J Neurosurg* 21 : 365-369, 2007
14. Rozin L, Rozin R, Koehler SA, Shakir A, Ladham S, Barmada M, et al. : Death during transforaminal epidural steroid nerve root block (C7) due to perforation of the left vertebral artery. *Am J Forensic Med Pathol* 24 : 351-355, 2003
15. Sasso RC, Macadaeg K, Nordmann D, Smith M : Selective nerve root injections can predict surgical outcome for lumbar and cervical radiculopathy : comparison to magnetic resonance imaging. *J Spinal Disord Tech* 18 : 471-478, 2005
16. Slipman CW, Lipetz JS, Jackson HB, Rogers DP, Vresilovic EJ : Therapeutic selective nerve root block in the nonsurgical treatment of atraumatic cervical spondylotic radicular pain : a retrospective analysis with independent clinical review. *Arch Phys Med Rehabil* 81 : 741-746, 2000
17. Vernon H, Mior S : The Neck Disability Index : a study of reliability and validity. *J Manipulative Physiol Ther* 14 : 409-415, 1991