

Initial evaluation of pain relief efficacy of ultrasound-guided selective nerve root injection with corticosteroid in the treatment of cervical disc herniation

Hoang Quang Cuong, Bui Hoang Anh,
Nguyen Minh Son, Tran Thi Thanh Huyen,
Nguyen Thi Thuy Nga, Nguyen Viet Khoa,
Vu Thi Thanh Hoa

108 Military Central Hospital

Summary

Objective: To evaluate the pain relief efficacy of selective nerve root injection with corticosteroid under ultrasound's guidance in the treatment of the cervical disc herniation and its complications. **Subject and method:** The study was conducted with 20 cervical disc herniation patients in the Center of Multidisciplinary Consultation and Treatment, 108 Military Central Hospital from February 2021 to May 2021. All included patients were examined and performed the first injection, then observed for 2 hours after the procedure. The second injection would be indicated if the first one was not able to relieve 50% of pain at each time points of study. The time points of study were T_0 , T_1 , T_2 , T_3 according to before, at a time, and after intervention 2 weeks and 4 weeks. The researched outcomes were vital signs, general status, Numeric Rating Scale (NRS, for pain assessment), and complications. **Result:** The average age of subjects was 54.75 ± 12.07 years old. Gender ratio (male/female) was 1.22. The most common herniated level was C5-C6 (90%), mainly right orientation (67%). The most frequent compressed nerve root was C6 right (67%). The NRS score at the time points after intervention significantly reduced, and this favorable outcome steadily maintained ($p < 0.05$). The most popular complication was the parasympathetic reflex (10%), it gradually disappeared with conservative care. There was no severe complication. **Conclusion:** The selective nerve root injection with corticosteroid under ultrasound's guidance in the treatment of cervical disc herniation is the acceptably safe and effective management.

Keywords: Selective nerve root injection, corticosteroid, ultrasound's guidance, cervical disc herniation.

1. Background

The prevalence of cervical disc herniation is around 83 cases/100.000 in American population [6]. The most common clinical manifestation is cervical pain which radiates to shoulder, arm, forearm, hand

and fingers. At the herniated site, there are a large number of cytokines such as Interleukin 6, substance P, bradykinin, and TNF-alpha... which play an important role in local inflammatory response and cause the radicular pain pattern. The first treatment is mainly conservative, ranging from medication, physical rehabilitation, traditional medicine, to lifestyle change and exercises. If the patients are unresponsive with those types of treatment, the minimal invasive interventions will be necessary, in order to locally administrate the anti-inflammatory

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Correspondence to: Vu Thi Thanh Hoa - Department of Rheumatology, 108 Military Central Hospital

Email: bsvthanhhhoa@gmail.com

agents, which inhibit the response at site, then reduce the nerve roots compression, and finally relieve the pain and enhance life quality. There are many approaches, among those, the nerve root selective block is widely chosen because of its safety, rapidity and efficacy. In the development of ultrasound, this technique becomes more accurate, and less complications such as vascular or nerve root injuries. Time of intervention would be also reduced with the same favorable outcome. Therefore, this study aims to: *Initial evaluation of pain relief efficacy of ultrasound-guided selective nerve root injection with corticosteroid in the treatment of cervical disc herniation, and its complications during and after intervention.*

2. Subject and method

2.1. Subject

20 cervical disc herniation patients.

Inclusion criteria

Diagnosed with cervical herniation with typical neurologic pain pattern. Confirmed by the correspondence between the clinical manifestations and MRI's characteristics.

Conservative treatments (NSAIDs, anti-epileptic drug, muscle relaxant) and physical rehabilitation at least 3 months without improvement (NRS score ≥ 4).

Consented patients.

Exclusion criteria

Spinal cord compression with motor and sensory defects. Severe foraminal and spinal stenosis in MRI and other spondylosis which causes radicular pain.

Coagulation disorders, under coagulating agents; corticosteroid or lidocaine hypersensitivity.

Cutaneous and subcutaneous infection.

Difficulty in ultrasound screen.

2.2. Method

Study design: Interventional, prospective study for the duration of 4 weeks.

Patients were examined, and selected in the study in case of criteria's satisfaction. Patient's pain

was assessed before and after intervention. The complications were also recorded. After 2 hours of observation, patients were invited for the next check-up after 2 weeks. Two weeks later, if the pain had reduced less than 50%, the patients would have been performed the second intervention. A check-up for 4 weeks later was also set.

The criteria in the study

Disc herniation causes radicular pain pattern diagnosed by clinical examination characterized with the downward pain's radiation and positive Spurling test [1].

The localization the disc herniation: Based on the correspondence between clinical manifestations and MRI's characteristics:

The root C5: Pain's dermatome is the postero-lateral of arm and elbow.

The root C6: Pain's dermatome is the first and second fingers.

The root C7: Pain's dermatome is the third finger.

The root C8: Pain's dermatome is the fourth and fifth fingers.

Technical injection (by Narouze S.N.)

Step 1: Patient in prone position, head tilts to the contralateral side.

Step 2: Gradually move the probe upward to identify the transverse process of other vertebrae (C5, C6). Simultaneously identify the adjacent vessels by Doppler ultrasound.

Step 3: Identify the targeted nerve root.

Step 4: Local anesthesia by lidocaine 1% \times 1ml.

Step 5: The prepared mixture of 3ml lidocaine 1% + 50mg hydrocortisone is injected.

Step 6: Withdraw the needle, locally disinfect, bandage in 24 hours. Closely observe 2 hours after the procedure

The outcomes

Evaluation of the pain relief - Numeric Rating Scale (NRS):

NRS [10] classifies the pain according to the scale from 0 to 10: (1) 0: No pain; (2) 1 - 3: Mild pain; (3) 4 - 6: Moderate pain; (4) 7 - 10: Severe pain.

Patient's pain was evaluated at the time points: Before intervention (T_0), right after intervention (T_1), after 2 weeks (T_2) and after 4 weeks (T_3).

The intervention will be considered as favorable if the pain reduces a half in comparison with the initial evaluation (T_0). At the time point T_2 , if the outcome is evaluated unfavorable, the second injection will be taken place. At the time point T_3 , if the outcome maintains negative, the patient will be referred to orthopedist.

The NRS would be compared between each time points. The ΔT was statistically tested to make sure the significant difference.

Evaluation of the complications:

Parasympathetic reflex: Manifests during and after intervention with the symptoms of dizziness, nausea, and vomiting. Management includes Trendelenburg position during 20-30 minutes.

Hematoma: Investigated by echography after intervention. Pressure application during 5 minutes is the main management.

Nerve root's damage: Muscle weakness, loss of sensation, reduction of muscle reflex. The symptoms last several weeks and months. Management bases on the medication which acts mainly on nerve's recovery.

Lidocaine hypersensitivity: Manifests during and after intervention with the symptoms such as tachycardia, hypotension, arrhythmia, anxiety, and seizure. Management includes intravenous lipid 20%, and according to the recommendation of Ministry of Health in Vietnam.

Intravenous infiltration: Presents during intervention with the symptoms similar with lidocaine hypersensitivity.

Location and time.

The Center of Multidisciplinary Consultation and Treatment, 108 Military Central Hospital from February 2021 to May 2021.

2.3. Data analysis

SPSS software. T-test was used with standard distribution variable. The statistical significance was defined if $p < 0.05$.

3. Result

Table 1. General Characteristics

Characteristics (n = 20)		Results
Age (± SD) (years old)		54.75 ± 12.70
Sex ratio (Male/Female)		1.22 (11 male/9 female)
BMI (± SD) (kg/m ²)		22.46 ± 2.47
Disc herniation level (n, %)	C5-6	18 (90%) (right side orientation 67%, left side orientation 33%)
	C6-7	2 (10%, right side orientation no left side orientation)
NRS before intervention (± SD)		7.16 ± 0.71
Patients with one intervention (n, %)		15 (75%)
Patients with two interventions (n, %)		5 (25%)

Table 2. NRS score at the time points

NRS	T_0 (before intervention)	T_1 (right after intervention)	T_2 (after T_0 2 weeks)	T_3 (after T_0 4 weeks)
(± SD)	7.16 ± 0.71	1.33 ± 0.88	3.08 ± 1.92	2.33 ± 2.01
Comparison vs T_0		$\Delta T_{1-0} = -3.08$ $p < 0.05$	$\Delta T_{2-0} = -2.95$ $p < 0.05$	$\Delta T_{3-0} = -3.08$ $p < 0.05$

Comparison vs T ₂				$\Delta T_{3-2} = -0.75$ $p > 0.05$
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Table 3. The change of blood pressure and pulse

Index	T ₀ (before intervention)	T ₁ (right after intervention)	p ₁₋₀
Pulse (± SD) (beats/min)	80.25 ± 9.44	80.33 ± 7.57	≥0.05
Systolic pressure (± SD) (mmHg)	140.91 ± 17.51	137.00 ± 16.99	≥0.05
Diastolic pressure (± SD) (mmHg)	78.58 ± 8.10	78.58 ± 7.34	≥0.05

Table 4. The other complications

Complications	n, %
Lidocaine hypersensitivity	0/20 (0%)
Intravascular infiltration	0/20 (0%)
Parasympathetic reflex	2/20 (10%)
Hematoma, hemorrhage	0/20 (0%)
Nerve root injury	0/20 (0%)

4. Discussion

4.1. General characteristics

The average age of subjects was 54.75 ± 12.07 years old. Male/female ratio was 1.22. The average BMI was $22.46 \pm 2.47 \text{ kg/m}^2$. The most common herniation level was C5-C6, took place 90%, mainly right side orientation 67%. The average NRS score before intervention was 7.16 ± 0.71 . The most common compressed nerve root was C6 right, took place 67%. There were 5 patients (25%) who needed the second intervention to achieve long-term pain relief. The same study conducted by Jee J et al in 2013 with 55 patients showed the average age was 56.69 ± 9.32 years old. The gender ratio was nearly 1:1. The average BMI was higher than our result $23.51 \pm 2.13 \text{ kg/m}^2$. The most common compressed nerve root was C6 (40%) and C7 (32.7%) [3]. The differences could be interpreted by the sample size, the number of patients in the former is lesser than the later.

4.2. The pain relief

The NRS score at the studied time points T₀, T₁, T₂, T₃ were 7.16 ± 0.71 , 1.33 ± 0.88 , 3.08 ± 1.92 , $2.33 \pm$

2.01 , respectively. In comparison with the T₀ time point, the pain relief was statistically significant with $p < 0.05$ according to T₁, T₂, T₃ time points. NRS right after intervention (T₁) was substantially decreased in comparison with the previous time point (T₀), then it was slightly increased after 2 weeks (T₂). This fluctuation could be explained by the lidocaine's effect which would be disappeared after about 3 hours of administration. The NRS score between T₂ and T₃ were not statistically significantly different. These results were similar with the other study performed by Jee H et al 2013 with 55 patients [3]. It showed that the efficacy of 50% reduction of VNS score (Verbal Numeric Scale) was seen after intervention 2 weeks and lasted in 1 year. In 2020, Jang JH et al also showed the efficacy of 60% reduction of VNS score after 2 weeks and which lasted up to 3 months [4]. There was variety of measurements of pain. The NRS used in our study was performed with the pain's ruler which could be easier to demonstrate than VNS based only on the verbal description of the patients.

4.3. Complications

There was no difference of cardiovascular signs between the before and the after intervention points, p value ≥ 0.05 . The most common complication was parasympathetic reflex (10%), including dizziness, nausea, and vomiting. These symptoms would disappear with the Trendelenburg position, hydration and rest. This prevalence was higher than the other studies with the larger sample size. Huston CW (2005) showed that among 151 patients, the prevalence of dizziness was 2.2%, nausea and vomiting was 1.1%, non-specific headache was 4.5% and all these symptoms disappeared after intervention 1 week [5]. These complications were considerably caused by vasovagal reflex. Pobiel RS (2009) conducted the selective nerve root infiltration with corticosteroid under fluoroscopy in 659 patients. It demonstrated the prevalence of vasovagal reflex was 2.8% [6].

5. Conclusion

The selective nerve root infiltration with corticosteroid under ultrasound's guidance in term of cervical disc herniation treatment is helpful to relieve the pain and acceptably safe.

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