ORIGINAL ARTICLE

Subscapularis motor point block for spastic shoulders in patients with cervical cord injury

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Study design: Case series.

Objective: The objective was to study the effect of phenol blocks to the motor points of the subscapularis muscle in patients with cervical cord injury (CCI).

Setting: Spinal cord injury units of a national hospital in Tokyo.

Methods: The participants were seven patients with traumatic CCI, mean age 55.8 years (SD4.0), whose injury level were at the fifth cervical level and the American Spinal Injury Association (ASIA) impairment scale was A in 2, C in 1 and D in 4. They were at least 5 months post-acute injury, and complained of pain and limited range of motion (ROM) of their shoulder joint that were unresponsive to usual rehabilitative interventions and medications. Before and after the phenol block to the motor points of the subscapularis muscle, we compared passive and active ROM of the shoulder (flexion, abduction and external rotation), spasticity of the subscapularis as assessed with the modified Ashworth scale, pain as evaluated with a visual analog scale, and eating item of the Functional Independence Measure.

Results: There were significant improvements in passive ROM in flexion (23.7°), abduction (19.4°) and external rotation (16.8°; $P < 0.05$). Visual analog scale for shoulder pain was reduced from 6.0 to 3.4 ($P < 0.05$). The modified Ashworth scale for shoulder spasticity, however, did not significantly change. The eating Functional Independence Measure item score improved significantly ($P < 0.05$).

Conclusions: This study suggests that subscapularis motor point block for pain and limited ROM with spastic shoulder is a useful technique in patients with CCI.

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Keywords: phenol block; contracture; pain; spasticity; ADL

Introduction

In persons with cervical cord injury (CCI), spasticity and pain around the shoulder joint and its consequent limitation of range of motion (ROM) can interfere with their activities of daily living (ADL), and can be an important obstructive factor to rehabilitation. The incidence of shoulder pain in acute CCI has been reported to range from 51 to 78%.¹ Waring *et al.*² reported that over half of the patients developed shoulder pain within 2 weeks of the spinal injury. A higher level of CCI was associated with a higher incidence of pain.¹

Shoulder pain can limit participation in rehabilitative activities and reduce the time available for functional retraining. It has been reported to increase with upper extremity dressing, transfers and reaching.³ Loss of independence can have financial consequences and increase the

physical burden on caregivers. Shoulder pain may, therefore, be functionally and economically equivalent to a higher lesion level.^{1,4,5}

In particular, for those suffering from central cord syndrome, whose proximal arm function is usually disturbed from the outset, aggravation of spasticity around the shoulder can be detrimental. When these shoulder problems are not properly managed, a vicious cycle of pain, aggravation of spasticity and further limitation of ROM can intervene. In this situation, therapeutic measures, such as injection of analgesics into the shoulder joint or suprascapular nerve block would not be effective.

The rotator cuff muscles are innervated by the C4–7 segments and partial lesions at these levels can cause either lower motor or upper motor neuron lesions. When the subscapularis muscle suffer from upper motor neuron lesions, it becomes spastic and because of its spasticity usually overwhelms the relative weakness of the rest of the rotator cuff muscles, internal rotation and adduction contracture of the shoulder joint with associated pain occurs.^{6,7} This can lead to the reduced external rotation

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and insufficient acromial elevation and potential tendon impingement.¹

Therefore, subscapularis motor point block can potentially be effective to remedy spastic shoulder pain in patients with CCI, but reports have been so far limited to patients with stroke.^{8–11} The purpose of this study is to examine the effects of subscapularis motor point block for shoulder problems in persons with CCI.

Methods

From the 130 CCI patients receiving rehabilitation therapy at spinal cord injury units of Murayama Medical Center in Tokyo during 2004–2006, we recruited seven patients with traumatic CCI according to the following criteria:

- (1) The candidates were at least 5 months post-acute injury.
- (2) They had marked limitation of shoulder active ROM (flexion $<60^\circ$, abduction $<60^\circ$, and external rotation $<5^\circ$) resulting from severe shoulder pain and spasticity that had not been improved with muscle relaxants, therapeutic exercise and/or shoulder joint injection.

The participants consisted of six men and 1 woman, and their mean age was 55.8 years (s.d. = 4.0, range = 50–61). All of their injury level was at the fifth cervical level (C5), and their impairment level, as classified according to the American Spinal Injury Association (ASIA),¹² was A in two patients (bilateral in one patient and right in another), C in one patient (left side) and D in four patients (right in two patients and left in two patients).

The procedure for subscapularis motor point block followed that described by Hecht *et al.*^{8,9} The patient was positioned lying on one side, with the injection side up and arms propped to produce as much winging of the scapula as possible. The needle was inserted under the medial edge of the scapula at the level of the spine of scapula. Teflon-coated 100-mm needle (Top Corp., Tokyo, Japan) was used and slid along the anterior surface of the scapula.

To localize a motor point, weak electric stimulation (1 mA) was delivered with a chronaximeter (OG Giken Corp., Okayama, Japan) through the needle. At a point where the strongest muscle contraction was observed, 0.2–0.3 ml of 5% phenol was injected, and successful blocking was confirmed by observing the disappearance of contraction.

Before and 24 h after the injection, the following outcome measures were assessed: passive and active ROM of the shoulder joint (flexion, abduction and external rotation); spasticity of shoulder flexors and external rotators as evaluated with the modified Ashworth Scale;¹³ shoulder pain as measured with a 10-cm visual analog scale; muscle strength for shoulder flexion, abduction and external rotation as evaluated with the manual muscle test according to the Medical Research Council grade;¹⁴ ADL related with upper extremity functions as measured with the eating item of the Functional Independence Measure (FIM).¹⁵

The before and after measurements were compared with the paired *t*-test and the Wilcoxon signed-rank test using a statistical software Statcel (OMS, Saitama, Japan) for Windows. The level of significance was set at $P < 0.05$.

The study was approved by the institutional ethics review board of our facility. The purpose and procedures of the study were fully explained, and informed consent was obtained from the participants.

Results

All the motor point blocks were performed without complications. As demonstrated in Table 1, statistically significant improvement was observed for passive ROM of shoulder flexion (23.7°), abduction (19.4°) and external rotation (16.3° ; paired *t*-test, $P < 0.05$). The visual analog scale for shoulder pain improved from 6.0 to 3.4 (paired *t*-test, $P < 0.05$). The modified Ashworth scale ratings, which scored 3 in all cases before the injection, did not significantly change after the injection. The manual muscle test ratings also did not change significantly for flexion, abduction and external rotation (Wilcoxon signed-ranks test, not signifi-

Table 1 The effects of motor point block of the subscapularis muscle

Subject (age, side)	1(59, left) Before/after	2(61, left) Before/after	3(58, right) Before/after	3(58, left) Before/after	4(50, right) Before/after	5(52, left) Before/after	6(52, right) Before/after	7(56, right) Before/after
Flexion*	90/105	50/60	90/110	70/95	30/90	85/95	75/90	45/80
Passive ROM abduction*	75/95	40/55	65/90	65/100	70/80	80/85	65/75	65/100
ER*	5/10	–20/0	25/40	15/40	10/30	–10/0	25/35	0/25
Flexion	55/80	30/40	30/35	15/15	20/45	15/15	20/70	30/60
Active ROM abduction	55/80	30/40	20/30	20/20	45/60	55/65	20/30	20/50
ER	0/0	–30/–15	5/5	5/5	0/20	–40/–20	–10/0	–15/0
Flexion	3–/3–	3–/3–	3–/3–	2/2	2/2	2/2	2/3–	3–/3–
MMT abduction	3–/3–	3–/3–	3–/3–	2/2	3–/31	2/2	2/2	2/3–
ER	1/1	1/2	2/2	1/1	1/2	1/2	1/2	1/2
MAS	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
VAS [#]	5/3	7/3	5/4	5/5	5/2	8/5	10/2	8/3
Eating FIM item [#]	2/5	2/5	1/5	1/5	2/6	1/5	4/6	4/6

Abbreviations: ER, external rotation; FIM, Functional Independence Measure; MAS, modified Ashworth scale; MMT, manual muscle test; ROM, range of motion; VAS, visual analog scale.

*Paired *t*-test, $P < 0.05$.

[#]Wilcoxon signed-ranks test, $P < 0.05$.

cant). The eating item score of the functional independence measure improved significantly from 2.3 to 5.4 (Wilcoxon signed-ranks test, $P < 0.05$), that is, from the assistance levels to supervision or independent levels.

Discussion

Problems around the shoulder joint, including pain, functional limitations and their social impact have not been studied sufficiently in patients with CCI, and little is known about their appropriate management and its outcomes.¹⁶ Many patients seek medical treatment for pain, and receive physical therapy, pharmacological treatment or massage.¹⁶ Botulinum toxin injection is currently a popular treatment modality for spasticity,¹⁷ but reports are limited on how to inject it into the subscapularis muscle.⁶ Furthermore, it is not approved to use for shoulder spasticity in Japan.

Subscapularis motor point block for spastic shoulder pain is reported in patients with stroke.^{8–11} But as far as we know, our study is the first to report its application to patients with CCI. When patients with CCI have contractures and pain in the shoulder joint, ADL to upper extremity, such as eating, grooming and dressing can be restricted.¹⁸ This can be improved with improvement in shoulder ROM and reduction in spasticity. In our study, eating had been difficult in all patients before the intervention. After the subscapularis motor point block, however, shoulder ROM and spasticity improved, and eating became more independent.

Hecht *et al.*^{8,9} described subscapular nerve block in painful hemiplegic shoulder. They reported that stroke patients demonstrated more excessive contraction of the subscapularis muscle during shoulder flexion as compared with healthy controls, and that shoulder pain with severe spasticity was improved with subscapularis motor point block. Hara *et al.*¹⁰ also showed in 11 patients with spastic hemiparetic stroke that percutaneous phenol blocks to the motor points of the subscapularis muscle was a useful technique to remedy their shoulder pain and limited active shoulder movement.

The subscapularis muscle acts as a shoulder internal rotator and controls anterior dislocation of the humeral head.¹⁹ Moreover, it is innervated by upper and lower subscapular nerves.¹⁹ The upper subscapular nerve is composed of more than two branches. Therefore, the positions and the number of motor points of subscapularis vary individually, which makes it difficult to search for the motor points.

Furthermore, there is a problem of blind puncture in the motor point block to the subscapularis muscle. If one does not carefully confirm the point of the needle, there is a risk of pneumothorax. Moreover, hemorrhage is a potential complication.⁸ To avoid these complications, it is necessary to make the paretic scapula wing as much as possible, so that enough space is created between the medial edge of the scapula spine and trapezius muscle. Through this space, we punctured the needle into the subscapularis muscle to the direction of acromion. With this procedure, the risk of complications could be reduced.

Chiodo *et al.*²⁰ reported three approaches for needle insertion into the subscapular muscle—a posterior axillary approach, a medial scapular approach and a superior

scapular approach. They described that the posterior axillary approach was the most effective compared with other two approaches. However, they reported that subscapular motor point block was difficult with all the three approaches tested. In our study, we used the medial approach based on Hecht *et al.*,^{8,9} and obtained improvement in several of the outcome measures without complications.

In conclusion, although this was a small sample size study without controls, motor point blocks to the subscapularis muscle could be effective to improve upper extremity related ADL by improving limited ROM and pain of the shoulder joint in persons with CCI.

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