

—Report on Experiments and Clinical Cases—

Injury of Superficial Radial Nerve on the Wrist Joint Induced by Intravenous Injection

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Abstract

Eleven cases of injury of the superficial radial nerve on the wrist joint, caused by intravenous injection of a needle. Paralysis occurred immediately after injection of a needle into the cephalic vein of the wrist joint, which was immediately recognized by the patients themselves. Six patients who had only sensory disturbance without causalgia were subjected to follow-up observation; 5 patients with causalgia were administered with steroid infiltration injection 3 to 5 times. Of the latter 5 patients, one patient underwent surgery because the steroid infiltration injection showed no effects. Four patients (36.4%) completely recovered within three months, while 7 patients (63.6%) continued to show nervous symptoms. We concluded that intravenous injection of a needle should be performed at the wrist joint only when it is inevitable. (J Nippon Med Sch 2003; 70: 355–359)

Key words: Superficial radial nerve, needle, injection

Introduction

Among the nerves that govern the upper limbs, the superficial radial nerve is most easily injured, particularly at parts ranging from around the wrist joint to the dorsal side of the palm, due to its anatomical characteristic. Since this nerve is purely a sensory nerve, its injury does not affect motor function; in addition, since it governs the dorsal side of the hand and fingers, its injury is considered not to hamper daily activities. Therefore, injuries of the superficial radial nerve tend to be given less importance than those of the deep radial nerve, median nerve or ulnar nerve. However, once this nerve is injured, in many cases excruciating pain

and discomfort feeling in the hand persist for a long time, and the treatment is often difficult¹⁻³.

In this study, we report our experience in treating injury of the superficial radial nerve on the wrist joint caused by intravenous injection of a needle, together with the results of the treatment as well as the examination of the morbid state and preventive measures.

Subjects and methods

The subjects of this study were 11 patients (4 males and 7 females) one limb each of which was injured during a checkup or treatment of another disease in our hospital, and who visited our department for treatment of the injury, between

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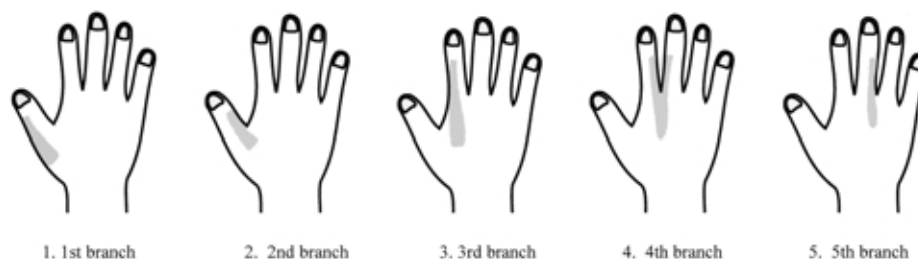


Fig. 1 Branches of superficial radial nerve.

Table 1 Classification of residual symptoms

Excellent	Paralysis that completely recovered objectively and subjectively
Good	Paralytic symptoms that either objectively or subjectively remained, but did not disturb daily activities
Fair	Paralytic symptoms that either objectively or subjectively remained, and disturbed daily activities
Poor	No improvement in paralytic symptoms

April 1994 and March 2000. The ages of the patients ranged from 25 to 65 years, with an average age of 46.4 years old. The injured wrists were those of the right hand for 5 patients and those of the left hand for 6 patients.

The major complaints were numbness and excruciating pain in the region of the superficial radial nerve at their first visit to our department. Hypesthesia, paresthesia and Tinel's sign were observed in all the patients, and causalgia was observed in 5 patients. Tinel's sign is a phenomenon in which lancinating pain occurs in the dominant region of the sensory nerve when the damaged site of the nerve is tapped. The hypesthesia was observed in the region from the first to the third branch among the five branches of the superficial radial nerve; the partial anesthesia was observed in one patient, while sensory disturbance of the entire region of the superficial radial nerve was not observed in any of the patients (**Fig. 1**).

Paralysis developed in all the patients immediately after intravenous injecting a needle into the cephalic vein on the wrist joint for the purpose of securing the vein or for treatment, which was immediately recognized by the patients themselves, and this was before the injection of drugs; therefore, the paralysis was considered to be a direct result of stimulation or injury by the needle tip. The diameters of the needles used were 18 gauge in five patients and 21

gauge in six patients.

As treatment for the patients, only follow-up observation was given to patients with sensory disturbance without causalgia. For patients with causalgia, steroid was infiltrated around the disturbed region 3 to 5 times; when the steroid was not effective, surgery was performed.

We examined these patients in terms of treatment method, treatment process, and final improvement level of paralysis. Here, the evaluation of objective sensation was performed using a light touch test and a pin prick test. For general evaluation, residual symptoms were classified into four grade (**Table 1**).

Results

Treatment methods for the patients and their level of improvement in symptoms are shown **Table 2**. In 7 patients, tumors with a diameter of around 2 mm which were considered to be neuroma were palpated 4 to 8 weeks after the injury, at the region where the needle was injected, and did not disappear through the whole course.

Follow-up observation was only performed in 6 patients, and steroid infiltration injection was performed in 5 patients. In one patient, the steroid infiltration injection was not effective because of the desire to resume work as soon as possible; the work

Table 2 Detailed results of eleven patients

Patient No.	Age (y)	Gender	Injured Side	diameter of needle (gauge)	Branch of superficial radial nerve	Duration of Follow-up (Mos.)	Symptoms at first examination				Symptoms at final examination				Most Recent Result
							Tinel's sign	Sensory change	Causalgia	Neuroma	Tinel's sign	Sensory change	Causalgia	Neuroma	
1	52	F	left	18G	1st	9	+	hypesthesia	-	-	-	-	-	-	Excellent
2	54	F	left	21G	3rd	12	+	hypesthesia	-	-	-	-	-	-	Good
3*	54	F	left	18G	1st	16	+	hypesthesia	+	+	+	+	+	+	Fair
4	52	F	left	21G	1st, 2nd	9	+	hypesthesia	+	+	+	+	+	+	Good
5	25	M	right	18G	2nd	12	+	hypesthesia	-	-	-	-	-	-	Good
6	47	M	left	18G	1st	9	+	anaesthesia	+	+	+	+	+	+	Fair
7	53	F	right	21G	1st	8	+	hypesthesia	-	-	-	-	-	-	Excellent
8	38	F	right	21G	1st	10	+	hypesthesia	-	-	-	-	-	-	Good
9	42	M	right	21G	1st, 2nd	7	+	hypesthesia	+	+	+	+	+	+	Fair
10	65	M	left	18G	3rd	12	+	hypesthesia	+	+	+	+	+	+	Excellent
11	28	F	right	21G	1st	9	+	hypesthesia	+	+	+	+	+	+	Good

* operation was performed

involved the frequent use of fingers and hands, therefore, resection of the neuroma and suture of the nerve were performed (Fig. 2).

During the follow-up observation period that (average of 10.3 months), causalgia was still observed in two patients. Partial paresthesia was persistently observed in seven patients including the patient who underwent surgery, and Tinel's sign was observed in 8 patients. Pain sensation and paralysis of touch sensation completely disappeared in 4 patients, whereas they were still observed in 6 patients although at a lesser degree. In one patient, no change was observed compared to the status upon injury. The general evaluation was excellent in 3 patients, good in 5 patients, fair in 3 patients. The patients with "excellent" grading tended to recover within 3~5 weeks after the injury, and all symptoms disappeared within 3 months. In the patients with "good" grading, their only symptom was occasional discomfort feeling, for example, when they carried a handbag on their arm.

Discussion

In many of the past reports on radial nerve injuries, the injuries were caused by accidental wounds or inappropriate surgical operations^{1,7}; there are only a small number of reports in which injuries were induced directly by intravenous injection of needles or installation of catheters⁸⁻¹².

The superficial radial nerve is located in the deep layer of the brachioradialis at the forearm, and it runs subcutaneously at the distal region around the wrist joint, after passing through the region between the brachioradialis tendon and the extensor carpi radialis longus tendon⁴⁻⁶. The region where the nerve runs subcutaneously has little soft tissue, which is different from the location of the proper palmar digital nerve which is protected by the hard horny layer of epidermis and rich subcutaneous fatty tissue. Accordingly, the superficial radial nerve is easily injured by external stimuli¹³.

When a needle is injected, the wrist joint is subjected to ulnopalmar flexion; accordingly, the superficial radial nerve becomes strained and stiff. In

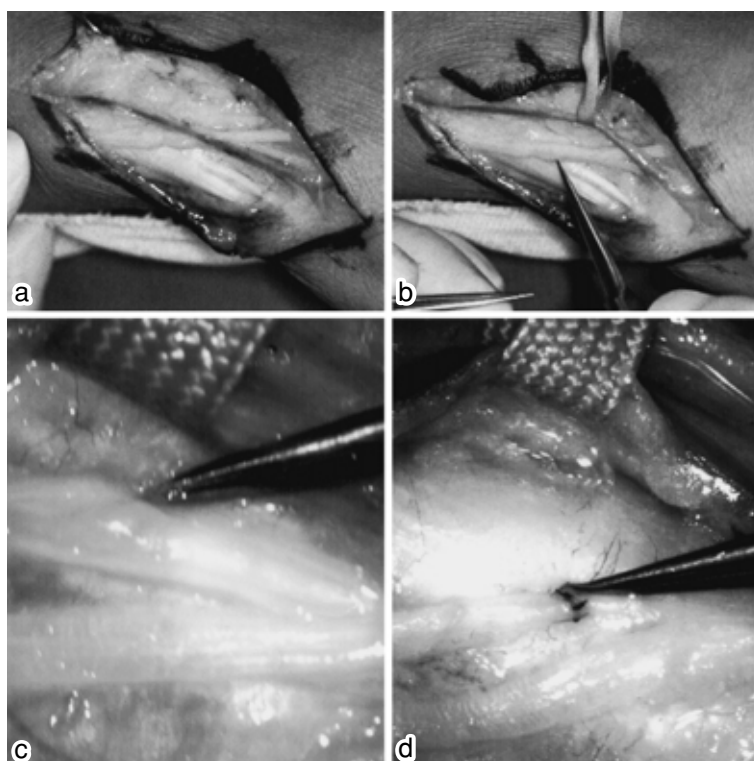


Fig. 2 A 54 year-old female

When an 18 G eraster needle was injected into the left wrist joint, strong pain appeared at the thumb and the index finger of the left hand. At her first visit, pain sensation at the region of the needle injection at the wrist joint, paresthesia in the superficial radial nerve region and causalgia were observed; therefore, steroid infiltration injection was performed 5 times. However, because her symptoms did not improve, surgery was performed.

a The superficial radial nerve intersects with the cephalic vein on the radial styloid process where the needle was injected. **b** Beneath the cephalic vein, the superficial radial nerve expanded immediately below the intersection, although continuity was maintained. **c** Under microscopic observation, a neuroma was found in this region. **d** The neuroma was resected followed by end-to-end suture repair.

addition, the superficial radial nerve intersects with the cephalic vein which is frequently used for injection of a needle at the radial styloid process¹⁴; therefore, there is a high risk of coming into contact with the superficial radial nerve with the injected needle.

Considering the shape and diameter of a needle, it is difficult to assume that the superficial radial nerve is completely cut by the injection. For the treatment of a partial breakage of the nerve trunk, even a surgical procedure is not effective and paresthesia tends to remain in patients based on our experience; therefore, it is difficult to explain the injury to the patient. When such an injury of the nerve occurs, in many cases, the physician may have said "this inconvenience will gradually and spontaneously

disappear," or "this is an accident and we have no responsibility." However, there is a possibility of medical lawsuits, and therefore, some preventive measures are required.

Boeson et al.⁹ and So et al.¹¹ stated that when a physician intends to install a catheter into the superficial vein at the wrist joint, he/she should note that the superficial radial nerve is near the injection region, and that when the patient claims paresthesia or numbness upon injection, he/she should immediately remove the catheter. However, the superficial radial nerve is bifurcated into several branches at the wrist joint and has many anomalous innervations; once the nerve is injured, its recovery takes a long time even if the catheter is removed immediately. Sheu et al.⁸ stated that injection of a

needle at the wrist joint should be performed only when there is no appropriate vein on the forearm; and that upon injection, the needle should have an inclination angle of 5~15 degrees relative to the skin. According to our experience, we also consider that the intravenous injection of a needle and the securing of a vein at the wrist joint should be performed only when injection into other regions is impossible, taking sufficient precautions and clarifying the anatomical position.

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