

# Ultrasound-Guide Hydrodissection for Ulnar Nerve Entrapment at Arcade of Struthers

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## ABSTRACT

**Background:** Ulnar nerve entrapment (UNE) causes a tingling or numbness in the fourth and fifth fingers and appears when provoked by bending the elbow. In some severe cases, UNE often causes weakness of the fourth and fifth fingers when grasping or difficulty in coordinating movements. In severe cases, it causes muscle atrophy.

**Case:** A 39-year-old male patient had complaints of pain and numbness in the right arm above the elbow radiating to the fourth and fifth fingers. There is a burning sensation on the right arm when exposed to the wind, with a visual analog scale (VAS) 4-5. Two years ago, the patient had a history of pain in his entire right arm and shoulder blade after falling from a cliff. The patient received treatment with mefenamic acid 500 mg, three times a day, ranitidine 150 mg, two times a day, but the pain did not improve. The patient was diagnosed with ulnar nerve entrapment at the arcade of Struthers. The patient was treated with hydrodissection using ultrasound guidance with 2% lidocaine and steroids (Triamcinolone Acetonide 40 mg/ml). Evaluation on the seven days after hydrodissection, burning sensation at the injection site, tingling and numbness have disappeared.

**Conclusion:** Ultrasound-guided hydrodissection is clinically effective in ulnar nerve entrapment at the arcade of Struthers management.

**Keywords:** hydrodissection, ulnar nerve entrapment, pain management

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## INTRODUCTION

Ulnar nerve entrapment (UNE) commonly occurs in the cubital tunnel of the elbow or wrist.<sup>1</sup> Symptom that may arise includes tingling or numbness in the fourth and fifth fingers that come and goes, which appears when bending the elbow. But in more severe cases, it often causes weakness in the fourth and fifth fingers when grasping or difficulty in coordinating movements.<sup>2</sup> Other symptoms includes difficulty moving the elbow, edema at the elbow, pain that worsen when pressure is applied to the elbow, and weakness in the hand from the affected ulnar nerve.<sup>3</sup> In chronic case with inadequate management, UNE lead hand muscle atrophy.<sup>4</sup>

Ulnar nerve entrapment is the second most common compression neuropathy in the upper extremity after carpal tunnel syndrome.<sup>5</sup> The incidence of UNE is around 0.8% annually, with severity varying from mild to severe.<sup>6</sup> Although the incidence is low, UNE is often found in industrialized countries as a result of poor work procedures or repetitive

movements over a long period. UNE is an upper limb work-related musculoskeletal disorder (WRMD) that often occurs in drivers, factory workers, music players, and other occupation with repetitive movements nor ergonomic. For long period, UNE can trigger epicondylitis, tendinitis, and nerve entrapment. Therefore, UNE often occurs at productive ages, which is around 30 to 50 years in almost the same proportion of males and females.<sup>6</sup>

UNE often shows atypical symptoms. Many UNE patients who come with complaints of tingling and numbness in fourth and fifth fingers come and go and have not shown any specific anatomical abnormalities. Sometimes patients come with no complaints so that the clinician cannot distinguish the presence of UNE and often diagnoses with a certain neuropathy. This is one of the reasons why UNE patients did not receive an appropriate pain management.<sup>6</sup>

Several diagnostic test may be done to assist UNE diagnosis, including the gold standard magnetic resonance

imaging (MRI), Electro neuro-myography (ENMG), X-ray, and ultrasound. However, MRI examination takes more time, is not available in all health facilities, and the results are often disrupted by the presence of artifacts. The examination using ENMG often show a normal result when done in patient who are not on their relaps. In addition, the availability of ENMG in health facilities is also limited. Examination using X-ray can only show conditions around the nerve without being able to visualize the ulnar nerve. Compared to the other diagnostic test modalities, ultrasound shows a promising technique because it was able to visualize and direct pain practitioners in UNE therapy.<sup>7</sup>

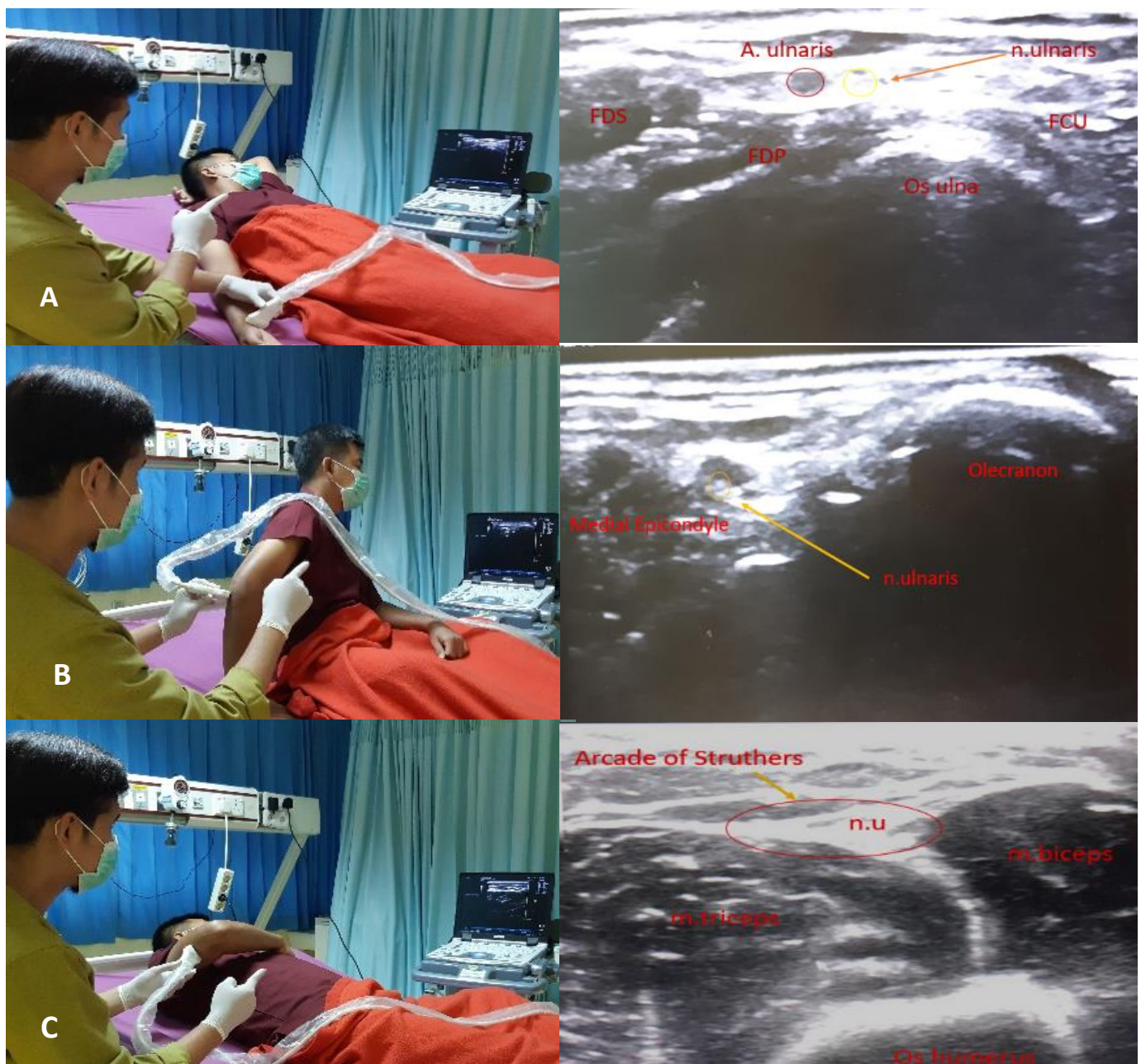
In mild and moderate cases, non-operative therapy using medication is recommended. Bracing or splinting is also often used to minimize the compression.<sup>4</sup> However, this technique makes patients uncomfortable and reduces patients' productivity. Occupational therapy was also found to be effective in reducing UNE's symptoms and severity.<sup>8</sup> However, the invasive procedure is needed to be considered when the symptom gets worse, interferes with daily activity, and causes disability. Surgical methods are divided into two major

categories, including simple ulnar nerve decompression with or without medial epicondylectomy. The second is subcutaneous, intermuscular, and submuscular anterior transposition procedures.<sup>9</sup> However, the outcome of those techniques remains controversial.<sup>9</sup> Decompression using transposition potentially causes new compression.<sup>7</sup>

Several disadvantages and adverse events from invasive techniques encourage clinicians to start using other more advance modalities. Hydrodissection is a novel technique in nerve entrapment management. Hydrodissection is done by introducing a solution between tissue planes to create a separation and tissue adhesion under an ultrasound guide.<sup>10</sup> It will release the adhesion of soft tissue or nerve entrapment.<sup>2</sup> This technique also could be performed in outpatients. In this case report, we report a successful diagnosis and management of UNE using hydrodissection under an ultrasound guide.

## CASE

A 39-year-old male patient came with the complaint of pain and numbness in the right arm above the elbow radiating to the fourth and fifth fingers. There is a burning sensation on



**Figure 1.** Nerve tracking. A. On the forearm between the flexor carpi ulnaris (FCU) and flexor digitorum profundus (FDP), B. On the elbow between the olecranon and medial epicondyle, C. ± 8 cm proximal to the medial epicondyle.

the right arm when exposed to the wind. Two years ago, the patient fell from a cliff, his entire right arm and shoulder blade felt sore, right upper arm was bruised, but there was no injury or pain in the head, neck area and other organs. The X-ray showed no fractures or fissures. The pain still persists after the bruise fully recover. He then consumes pain-relieving drugs (mefenamic acid 500 mg 3 times a day, ranitidine 150 mg two times a day), but the pain does not improve. One week ago, the arm began to feel a bit numb and tingling to the fourth and fifth fingers. There is a burning sensation when exposed to the wind. History of trauma, high blood pressure, diabetes, stroke, heart disease, and malignancy or tumor was denied.

The patient's general status appears to be moderately ill, and the health status is adequate. Compos mentis consciousness, Glasgow Coma Scale: eye response (E), vocal response (V), and motor response (M) E4V5M6. Vital signs blood pressure 130/80 mmHg, pulse 72 beats/minute, temperature 36°C, pain VAS 4-5, good skin turgor, normocephalic head, anemic conjunctiva eyes -/-, sclera icteric -/-, pupil isocor 3/3 mm, light reflex +. Symmetrical neck, no enlargement of the thyroid gland, no deviation of the trachea, no enlargement of lymph nodes, neck stiffness (-), meningeal sign (-), pain in the neck area (-).

Pulmonary examination revealed normochest, symmetrical chest wall, symmetrical chest wall expansion, resonance in both lung fields, vesicular (Normal/Normal), rhonchi (-/-), wheezing (-/-). Cor examination did not show ictus cordis, regular I and II heart sounds, Gallops (-), Murmurs (-). Flat abdomen supple. The abdominal wall is supple, skin turgor is good, the liver and spleen are not enlarged, there is no abdominal pressure pain, the tympanic membrane and bowel sounds are normal. Examination of the extremities revealed edema (-), cyanosis (-), muscle atrophy (-), capillary refill <2 seconds, warm (+), Tinel's sign (+) in the area 8 cm above the elbow.

#### Supporting examination

- Laboratorium test: Blood sugar level 108 mg/dL
- Nerve tracking using ultrasound (Figure 1A, B, C)

Nervus tracking shows that the diameter of the nerve is about 0.8 mm and is located beside the ulnar artery between the FCU and FDP. When tracked proximally, the diameter of the nerve is about 1 mm in the circumferential area and enlarges to 1.6 mm in the sulcus area. In the 8 cm proximal to the medial epicondyle, the ulnar nerve diameter of 2.1 mm is seen. According to Sivak et al.<sup>11</sup>, this is a sign of fascia thickening.

The patient was diagnosed with ulnar nerve entrapment at the arcade of Struthers with a differential diagnosis of muscle spasm and cervical radicular pain. The patient receives hydrodissection-ultrasound guide therapy using 2% lidocaine and steroid (triamcinolone acetonide 40 mg/ml). Treatment is done in the supine position. The forearm above the elbow is prepared using alcohol and betadine. The treatment area was then covered using a sterile drape. A nerve tracking-ultrasound guide was performed to visualize the ulnar nerve at the arcade of Struthers area. Local anesthetic 1% lidocaine was infiltrated in the marked area. A Spinocan 25 G needle (in-plane) puncture was performed in the arcade of Struthers area. After the tip of the needle was shown in the perineural space (indicated by a pop sensation when the needle penetrates the muscle fascia), then hydrodissection was

performed using 0.9% NaCl 5 ml + 2% lidocaine 4 ml + triamcinolone acetonide 1 ml (20 mg).

Examination on day three post-injection shows a burning sensation on the right forearm is still present. However, the tingling and numbness are reduced, and the burning sensation on the right arm when exposed to the wind is diminished. Evaluation on the seventh-day post-injection shows there is no more burning sensation, tingling, and numbness on the right arm.

## DISCUSSION

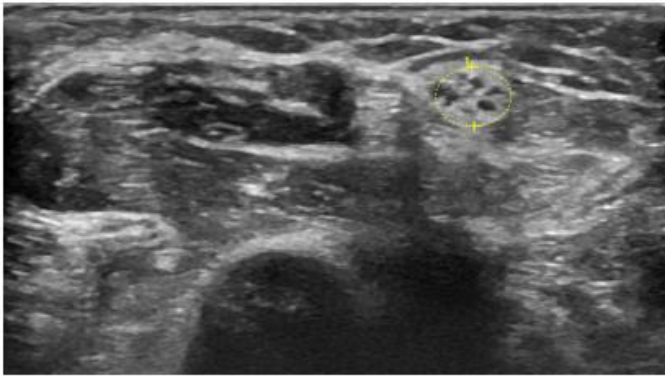
Ulnar nerve entrapment (UNE) is caused by compression or irritation of the ulnar nerve.<sup>4</sup> The ulnar nerve is a branch of the medial cord of the brachial plexus and consists of nerve fibers from the C8-T1 spinal nerve roots. The ulnar nerve courses along the arm just anterior to the medial part of the intermuscular septum.<sup>5,12</sup>

UNE often occurs in the elbow due to compression of the ulnar nerve by the surrounding tissue, inflammatory processes, or scarring, but sometimes UNE also occurs in the proximal area, such as in the arcade of Struthers area.<sup>12</sup> UNE in the Struthers area often only can be diagnosed by electromyography (EMG) and ultrasound (ULTRASOUND) and will be confirmed during the surgical.<sup>11</sup> Most of the compression in the upper arm takes place in the arcade of Struthers.<sup>13</sup> In 70-80% of cases, UNE occurs under the arcade of Struthers.<sup>11</sup> Arcade of Struthers form by the internal brachial ligament, the triceps's medial head, and medial intermuscular septum just proximal to the medial epicondyle of the humerus.<sup>12</sup>

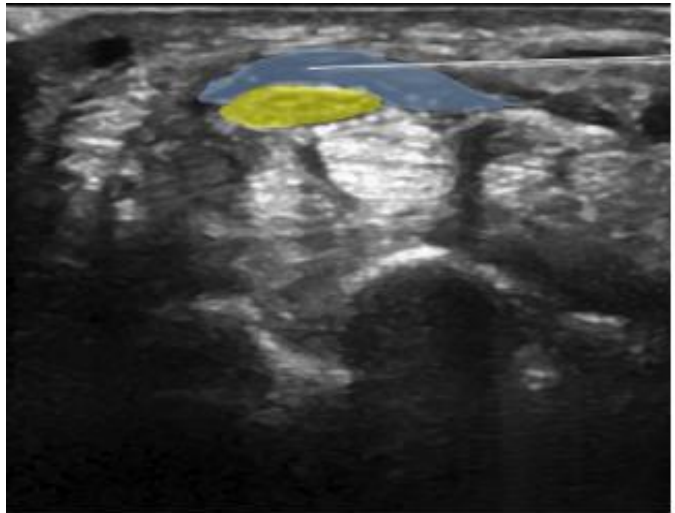
UNE is often caused by flexion of the fascia, subluxation of the ulnar nerve to the medial epicondyle, cubital valgus, bone spurs, synosial hypertrophy, tumor, ganglia, or direct compression of the ulnar nerve. Occupational activities that may trigger secondary UNE include repetitive flexion and extension of the cubital articulation. Factors that affect ulnar nerve neuropathy at or around the elbow includes body mass index, gender, smoking, alcohol, occupation, level of education, supporting activity, previous fracture around the elbow, hypothyroidism, diabetes mellitus, and hypertension.<sup>14</sup>

UNE often shows non-typical symptoms.<sup>15</sup> Many patients come with complaints of tingling and numbness in the fourth and fifth fingers that come and go and have not shown any specific anatomical abnormalities, even sometimes patients come when there are no complaints so that clinicians cannot detect the presence of UNE.<sup>3</sup> UNE often diagnosed with a specific neuropathy, thus making patient management inappropriate. Therefore, the enforcement of the UNE diagnosis is required from the foresight of a clinician in recognizing the symptoms of UNE and the risk factors of the patient so that the clinician can choose the right supporting examination in establishing the diagnosis of UNE. Several investigations such as X-Ray, Electro neuro-myography (ENMG), magnetic resonance imaging (MRI), or ultrasonography may be performed to help confirm the diagnosis.<sup>7</sup> The hydrodissection is carried out by injecting fluid into the tissue that requires intervention and is carried out with the help of ultrasound.<sup>10</sup> Hydrodissection, also known as a perineural deep injection, is a technique by injecting a volume of fluid into the scar tissue or fascia to release the pinch or grip on the nerve so that the peripheral nerves will move smoothly over the fascia

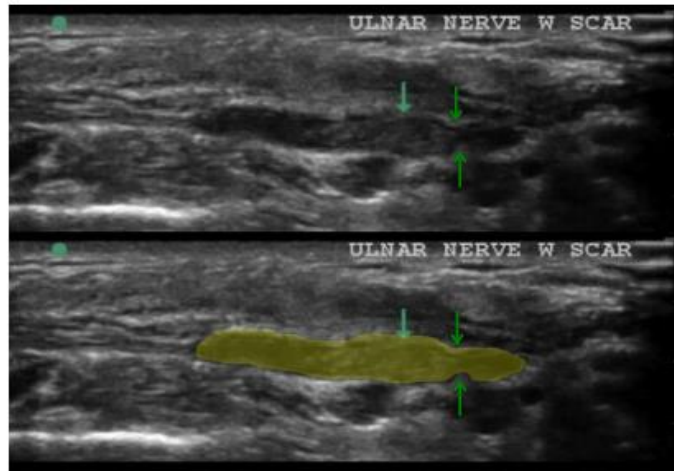




**Figure 2.** Hour-Glass Shape of compressed nerve<sup>10</sup>



**Figure 4.** Hydrodissection-ultrasound guide (cross-section)<sup>10</sup>



**Figure 3.** Compressed nerve showed a thickening <sup>10</sup>

This hydrodissection technique requires both the ability to identify the nerves using ultrasonography and safely and accurately manipulate the injection needle under ultrasound guidance. The goal of this technique is to place the needle tip perineural but not intraneural.<sup>10</sup> Using the ultrasound guide, the compressed nerve may appear in an "hour-glass" shape (figure 2) or thicken (figure 3). After the sterile preparatory procedure, subcutaneous infiltration of the local anesthetic was performed. After that, the nerve is identified transversely. The needle is inserted into the perineural space (figure 4). A number of aliquots and fluids can assist in identifying the fascia, which is visualized as a donut image due to the presence of hypoechoic fluid around the nerve. Then the ultrasound probe is rotated 90° so that it shows a longitudinal section of the nerve. All the fluid is then slowly injected while paying attention to the tissue that is starting to be flooded with fluid, sometimes you will feel a "pop" sensation by palpating the finger, and in an instant, the patient will feel the pain relieved.<sup>10</sup> Literature showed that hydrodissection provides a satisfying

result in the pain management of the upper extremity, including in carpal tunnel syndrome and ulnar neuropathy.<sup>16,17,18,19</sup> The recent study in ulnar neuropathy show that hydrodissection in-plane approach using 4ml 0.9% saline and steroid (40 mg/ml 1 ml methylprednisolone) for recurrent ulnar nerve neuropathy four years after anterior transposition provides a positive improvement (decrease in VAS score from 9 to 5 at 6-month follow-up).<sup>19</sup> In this case report, the first attempt of hydrodissection using the combination of 5 ml 0.9% NaCl, 4 ml 2% lidocaine, and 1 ml of 20 mg triamcinolone acetonide completely relieve pain seven days after injection.

Hydrodissection has a risk, including the incidence of intraneural injection, which leads to nerve damage. The intraneural injection can be seen when the diameter of the nerve enlarges during the injection. The intraneural injection is also characterized by nerves moving towards the needle when fluid is inserted. If the injection is carried out in the perineural space, the nerves will move away from the needle. Keep in mind that giving large amounts of fluid will cause another pinch, so it is necessary to pay attention to how many mL of local anesthetic fluid is given, normal physiological fluids, and D5W fluids. Several reports have been made of the efficacy of hydrodissection in the treatment of compressed peripheral nerves, such as the radius, ulnar, femoral, saphenous, peroneal, tibial posterior, plantar, ilioinguinal, and iliohypogastric nerves<sup>10</sup>

## CONCLUSION

Hydrodissection using an ultrasound guide has been proven to be effective in the treatment of ulnar nerve entrapment at the arcade of Struthers. Ultrasound also proved to be effective in assisting the diagnosis and treatment of ulnar nerve entrapment at the arcade of Struthers.

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## CONFLICT OF INTEREST

The author reports no conflict of interests

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