

Rehabilitation Management of a Patient with Median Nerve Entrapment from Venipuncture-associated Hematoma in Dengue Hemorrhagic Fever: A Case Report

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ABSTRACT

Dengue hemorrhagic fever is a severe form of dengue presenting commonly with bleeding diathesis, but rarely with peripheral nervous system manifestations. Proximal median neuropathy comprises 1% of upper limb compression syndromes, and this case is the first to report injury to the proximal median nerve due to compression from hematoma formation. This case report presents the rehabilitation process of a 25-year-old Filipino female median nerve entrapment from venipuncture-associated hematoma presenting as burning sensation on the medial elbow, forearm and hand, weak flexion movement of her left thumb, index, and middle fingers. The patient was managed conservatively with pain medications, range of motion, gross and fine motor, and sensory re-education exercises. At 12 months, there was partial but functional recovery of median motor distribution and full recovery of median sensory distribution, as evidenced by improved sensory nerve action potential conduction velocity and amplitude, and compound motor action potential conduction velocity, with persistent decreased amplitude at 50%, and decrease in cross-sectional area of the left median nerve.

This paper highlights the functional outcomes of a conservatively managed median nerve entrapment from venipuncture hematoma from dengue hemorrhagic fever. This case report also emphasizes that in the presence of severe bleeding risk of surgery in the background of severe thrombocytopenia, timely rehabilitation medicine referral with monitoring through clinical evaluation, musculoskeletal ultrasound, and electrodiagnostic study presents a viable alternative in the management of compression neuropathy.

Keywords: dengue hemorrhagic fever, compressive proximal median neuropathy, musculoskeletal ultrasound, nerve conduction study, rehabilitation, case report



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INTRODUCTION

Dengue is a mosquito-borne viral disease endemic in all regions of the Philippines.¹ Dengue hemorrhagic fever is a severe form of dengue fever that results from increased vascular permeability causing plasma leakage and subsequent hemoconcentration; and bone marrow suppression, causing thrombocytopenia and leukopenia.² Daily complete blood count is the recommended practice in managing dengue fever to identify the risk for hemorrhage and shock.³ In the normal population, diagnostic venipuncture causes petechiae and mild hematoma in 12.3% of patients⁴ and an even higher risk can be expected among Dengue patients.

While dengue hemorrhagic fever presents commonly with bleeding diathesis, it rarely causes peripheral nervous system manifestations. As of this writing, there are only two documented cases of dengue hemorrhagic fever developing

compressive neuropathies – 1) femoral nerve from iliopsoas hematoma and 2) ulnar nerve from an anterior forearm compartment syndrome.^{5,6} Both of these cases were managed surgically with evacuation of hematoma. Unlike these cases, this novel case report of a 25-year-old Filipino female with dengue hemorrhagic fever presenting with median nerve entrapment from venipuncture-associated hematoma was managed conservatively. Proximal median neuropathy comprises 1% of upper limb compression syndromes⁷, and this case is the first to report injury to the proximal median nerve due to compression from hematoma formation.

CASE PRESENTATION

A 25-year-old Filipino female, right-handed, medical doctor, with no known history of carpal tunnel syndrome and no previous or family history of metabolic or genetic disorder predisposing to neuropathies or bleeding diathesis, diagnosed with dengue fever presented on the sixth day of illness, second day of defervescence, with an acute hematoma measuring 6 x 6 cm on left antecubital fossa following venipuncture of median cubital vein for daily complete blood count monitoring (Figure 1). Few hours later, the patient presented with tingling sensation and numbness along the left medial forearm and hand, and weak grip. Radial pulse was full and equal, and capillary refill time was less than two seconds.

Patient was admitted and managed as a case of dengue fever with warning signs for five days. Laboratory work-up revealed positive dengue non-structural protein NS1 test, leukopenia (white blood count $3.59 \times 10^9/L$), thrombocytopenia (platelet count $33 \times 10^9/L$) and prolonged partial thromboplastin time (PTT) (43.2 seconds). Musculoskeletal ultrasound revealed subcutaneous edema. To mitigate the bleeding risk of surgery due to severe thrombocytopenia, the patient was managed conservatively with intravenous fluid for hydration,

platelet concentrate transfusion for thrombocytopenia, tranexamic acid for bleeding, intravenous paracetamol and oral pregabalin, icing, and elevation for pain and swelling. The patient was discharged with resolving hematoma, no recurrence of bleeding episode, and improving coagulation parameters.

One week post-injury, patient had burning sensation on the medial elbow, forearm and hand, weak flexion movement of her left thumb, index and middle fingers. On follow-up with an orthopedic hand specialist, she was diagnosed with median nerve entrapment and flexion contracture of the left elbow.

Six weeks post-injury, she was referred to the rehabilitation medicine physician where physical examination revealed a tender, resolving hematoma measuring 3 x 3 cm over the antecubital fossa associated with severe pain with numeric rating scale of 9/10. The left hand had thenar atrophy, and was positive for active benediction sign with weakness of all median nerve-innervated muscles with manual muscle test (MMT) score of 2/5, and decreased light touch and pin prick sensation of <10% over distribution of median nerve. There was also paresthesia over volar aspect of forearm with hyperalgesia. Additionally, the left elbow had a 45-degree extension lag. Figure 2 presents the summarized timeline of the case.

Diagnostic Assessment

Baseline Disabilities of the Arm, Shoulder, and Hand (DASH) Symptom Score showed moderate difficulty in activities of daily living, and work as a physician, and inability to play tennis. Musculoskeletal ultrasound revealed left elbow joint hemarthrosis, myositis of the left brachioradialis, left biceps tendinitis, left median neuropathy beginning proximal to elbow characterized by increased size of fascicles and cross-sectional area of the median nerve. Nerve conduction studies



Figure 1. Venipuncture-associated hematoma on left antecubital area.



Figure 2. Summarized timeline of the case.

ROM – range of motion, ADL – activities of daily living

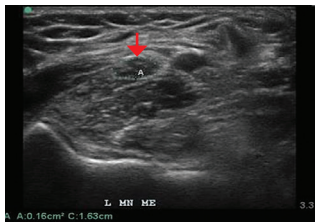

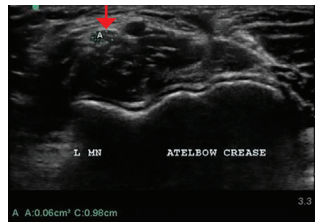
Table 1. Summary of Rehabilitation Management

Timeline	Problem List	Rehabilitation Goals	Rehabilitation Management
6 weeks post-injury	<ul style="list-style-type: none"> • Paresthesia and hyperalgesia, volar aspect of forearm (VRS 9/10) • Swelling 3 x 3 cm, left antecubital area • LOM, left elbow extension (140-45 degrees) • Weakness MMT 2/5 • Decreased light touch and pin prick sensation of <10% over median nerve distribution • Moderate limitations in ADLs and work • Unable to participate in tennis 	<ul style="list-style-type: none"> • Decrease pain • Decrease swelling • Improve range of motion • Improve strength • Improve protective sensation of left hand • Facilitate modified independence in performance of basic ADLs 	<p>Medications:</p> <ul style="list-style-type: none"> • Pregabalin 75 mg/capsule 1 capsule thrice daily • Vitamin B1 + B6 + B12 500 mg/250 mg/1 mg/tablet, 1 tablet twice daily <p>Physical therapy: cryotherapy, ultrasound with phonophoresis with indomethacin gel, electrical stimulation, and range of motion exercises</p> <p>Orthosis: Hinged-Elbow orthosis to promote elbow extension (Figure 3)</p>
4 months post-injury	<ul style="list-style-type: none"> • Weakness MMT 3-4/5 • Decreased light touch and pin prick sensation of 20-50% • Minimal limitations in ADLs, work, and tennis 	<ul style="list-style-type: none"> • Improve fine motor control of left hand • Improve protective sensation of left hand • Facilitate independent performance of basic and instrumental activities of daily living 	<p>Occupational therapy: grip strengthening, fine motor exercises, ADL training, sensory re-education</p>
12 months post-injury	<ul style="list-style-type: none"> • Weakness, left median nerve-innervated muscles (MMT 4/5) 	<ul style="list-style-type: none"> • Improve fine motor control of left hand 	<ul style="list-style-type: none"> • Continue home exercises • Discharge from rehabilitation medicine service

VRS – verbal rating scale, LOM – limitation of motion, MMT – manual muscle test, ADLs – activities of daily living

Table 2. Left Median Nerve Ultrasound Study

Location	Cross-sectional Area (baseline reference: right median nerve measurements)		
	6 th week post-injury	4 th month post-injury	12 th month post-injury
4 cm proximal to elbow crease	18 mm ² (7 mm ²)	11 mm ² (7 mm ²)	8 mm ² (7 mm ²)
At elbow crease	16 mm ² (5 mm ²)	10 mm ² (5 mm ²)	6 mm ² (5 mm ²)
4 cm distal to elbow crease	6 mm ² (3 mm ²)	3 mm ² (3 mm ²)	3 mm ² (3 mm ²)

L MN/ Med N – left median nerve, ME – medial epicondyle, PT – pronator teres, red arrow – median nerve

revealed left median neuropathy proximal to the elbow with axonopathic and myelinopathic changes.

Therapeutic Intervention

Patient underwent a series of comprehensive rehabilitation management as summarized in Table 1.

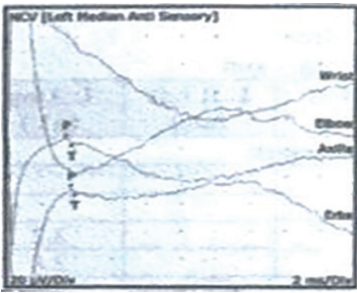
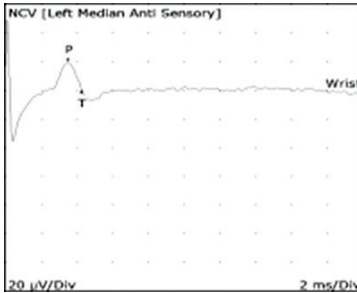
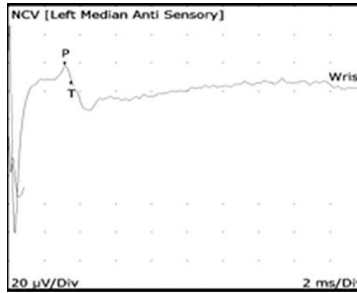
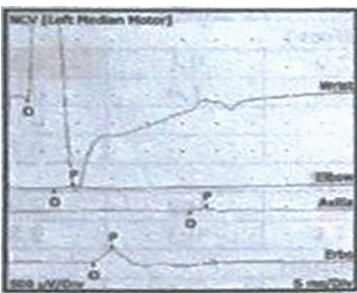
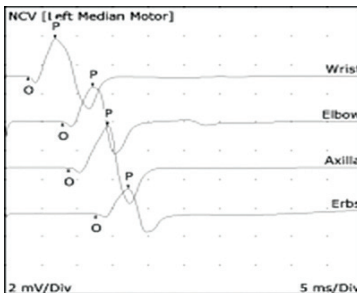
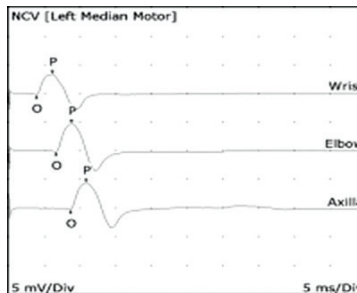
Follow-up and Outcomes

On subsequent follow-ups, the patient had regained partial recovery of the median nerve with MMT score of 4/5 and 95% intact sensation on median nerve distribution. Median nerve ultrasound monitoring revealed resolution of hematoma, and decreasing size of the fascicles and cross-sectional area of the median nerve from 16 mm² to 6 mm² at elbow crease (normal value 8.27 mm²)⁸, with comparable size to the contralateral median nerve (5 mm² at elbow crease) at 12th month (Table 2). Serial nerve conduction studies of

the median nerve showed improvement of sensory nerve action potential (SNAP) conduction velocity and amplitude at fourth month post-injury, while there is persistence of decrease in amplitude in compound motor action potential (CMAP), suggestive of persistent axonopathic injury (Table 3). Electromyography was not done.

Jamar Grip Dynamometer and Pinch Gauges, Purdue Pegboard Test and Semmes-Weinstein Monofilament Test were also facilitated during the 4th month and 12th month follow-ups to monitor the patient's strength, fine motor skill and safety, respectively (Table 4). Jamar grip dynamometer tests showed minimal improvement at 12th month post-injury. There is no significant change in dexterity and coordination as seen in Purdue Pegboard Test. Loss of protective sensation at fourth month post-injury has nearly caused an accident when the patient did not feel that her index finger was stuck in a jewelry box until she saw it. At 12 months,

Table 3. Median Nerve Conduction Study

Left Median Nerve	6 th week post-injury		4 th month post-injury		12 th month post-injury	
	Conduction Velocity (normal value)	Amplitude (normal value)	Conduction Velocity (normal value)	Amplitude (normal value)	Conduction Velocity (normal value)	Amplitude (normal value)
Sensory Nerve Action Potential	No response	No response	40 m/s (50 m/s)	18.8 uV (>10 uV)	44 m/s (50 m/s)	10.1 mV (>10 uV)
						
Compound Motor Action Potential	49 m/s (50 m/s)	4.8 mV (>5mV)	37 m/s (50 m/s)	2.6 mV (>5 mV)	63 m/s (50 m/s)	3.6 mV (>5 mV)
						

m/s - meters per second, mV - millivolts

Table 4. Jamar Dynamometer, Purdue Pegboard, and Semmes Weinstein Tests

Jamar Dynamometer	4 th month post-injury	12 th month post-injury
Grip strength	6.5 kg	8.5 kg (right: 17.4 kg)
Pinch strength		
Pad to pad	0 kg	0.5 kg (right: 2.3 kg)
Tripod pinch	0.5 kg	1.8 kg (right: 4.1 kg)
Lateral pinch	0.4 kg	2.6 kg (right: 4.7 kg)
Purdue Pegboard Test		
Right hand	Average	Average
Left hand	Poor	Poor
Both hands	Poor	Poor
Total	Poor	Poor
Assembly	Poor	Poor
Semmes Weinstein Monofilament Test		
Volar thumb	Diminished light touch	Normal
Volar index and middle fingers	Loss of protective sensation	Normal

Table 5. Disabilities of the Arm, Shoulder, and Hand (DASH)

DASH Symptom Scores	6 th week post-injury	4 th month post-injury	12 th month post-injury
Overall	57.76	16.38	6
Work Module: Physician	50	6.25	0
Sports Module: Tennis	100	31.25	12.5

Semmes Weinstein Test showed recovery of light touch and deep pressure sensation on the left median nerve distribution. Clinically, patient has mild residual hyperesthesia on left volar forearm which can be suggestive of undocumented superficial antebrachial cutaneous nerve affectation.

Functionally, the patient showed significant improvement in terms of Disabilities of the Arm, Shoulder, and Hand (DASH) Symptom Scores at 12th month with minimal limitations in activities of daily living and no limitation in her work as a medical doctor (Table 5).

DISCUSSION

There is increasing evidence of neurological manifestations of dengue fever, with incidence up to 5.4% in a Southeast Asian study.⁹ Neuromuscular signs comprise 5% of the neurological manifestations in dengue fever.¹⁰ The proposed pathogenic mechanisms for these conditions are immune-mediated reactions, systemic complications and viral neurotropism.⁹ In rare instances, a nerve is compressed by a hematoma. Ischemia, mechanical compression and in more severe cases, mechanical deformation characterized by nerve degeneration are the proposed mechanisms of nerve compression injuries.¹¹ To date, there are two reported cases of acute compressive neuropathy in a dengue patient (Table 6).^{5,6} In this patient's case, multiple venipuncture attempts at the left antecubital fossa led to the formation of a hematoma

Table 6. Summary of Case Reports

Authors	Patient	Neuropathy	Cause of compression	Management	Outcomes
<i>Mehtani, et al. (2013)</i>	26/M, pain and swelling, right forearm	Ulnar	• Perineural hematoma, from intravenous cannulation in the right cubital fossa	• Immediate fasciotomy and evacuation of hematoma	• 5 days post-op: Complete sensory recovery • 6 months post-op: Complete motor recovery
<i>Ganu, et al. (2013)</i>	55/M, pain and swelling, left groin	Femoral	• Spontaneous iliopsoas hematoma	• Surgical evacuation of hematoma • Physiotherapy	• 6 months post-op: Improved muscle strength (MMT 4/5); full functional recovery

that compressed or stretched the median nerve proximal to elbow. Injury at this level presents with neuropathic pain, weakness of pronators, wrist, and finger flexors, as seen in the patient.¹²

Electrodiagnostic study is a useful, time-dependent diagnostic tool in evaluating traumatic peripheral nerve injuries.¹³ Studies done from seven days to three months can help in prognostication and can guide treatment choices.¹⁴ A nerve conduction study done at 6th week post-injury confirmed the presence of a left median neuropathy proximal to the elbow, involving damage to the axon and myelin sheath. Improvements at the repeat studies suggest sensory nerve recovery, and remyelination on median motor fibers. The expected reinnervation beginning at two to three months post-injury in axonotmesis¹³ were not observed with CMAP persistently less than 50% of the contralateral side. It can be postulated that the relatively chronic nature of injury in the absence of surgical decompression could have impaired nerve regeneration. Earlier conduct of electrodiagnostic study and use of electromyography in subsequent studies could have helped in better understanding the recovery of the patient.¹³

While electrodiagnostic study was inconclusive, median neuropathy can also be screened through an enlarged nerve cross-sectional area as seen in ultrasound.⁸ In an Asian study, a cross-sectional area of 8.27 mm² of the median nerve at the elbow was considered normal.⁸ A decreasing cross-sectional area in the patient's median nerve from 16 mm² to 6 mm² may suggest an anatomically improving neuropathy. Clinically, the patient also demonstrated an improvement in strength, sensation, and function. The insignificant clinical difference in dexterity and coordination may be attributed to scarce opportunity to practice these skills in the patient's context.

Literature on the management and recovery of nerve compression injuries in dengue patients is limited. In the two published case reports, both patients were managed surgically through evacuation of hematoma and significant recovery was noted in three to six months. In this case, however, after close monitoring, multispecialty discussions, and careful consideration of surgical risks and prognostic factors, it was decided that surgery was not indicated and the patient was managed conservatively. The significant improvement in the patient's muscle strength, sensation, and disability at fourth month post-injury shows that conservative treatment can be an option in managing compressive neuropathies. Rehabilitation professionals can help in

alleviating compression and minimizing irritability of the nerve through physical modalities, splinting, and exercise.¹²

Given the paucity of evidence of conservative management of median nerve compression injuries at the elbow, it is currently unknown if the median nerve function would have improved in the same timeline without rehabilitation intervention. Further studies among non-surgical cases with case-control study design with recovery as outcome and rehabilitative management as exposure are recommended.

CONCLUSION

Dengue fever can present with neuropathies from nerve compression by a hematoma. Management is usually surgical, but conservative treatment can still be an option on a case-to-case basis. A timely, appropriate, and holistic rehabilitation program is necessary to reach full functional recovery. Musculoskeletal ultrasound, electrodiagnostic study, and functional hand capacity tests are helpful in diagnosing, prognosticating, and monitoring peripheral nerve injuries.

Patient Perspective

I, being a medical doctor, had a good grasp on the rarity of the complication from a venipuncture. This is not a case I usually see in the hospital in patients with dengue. It was my first time to experience such a limitation in the movement of my left arm and hand, add to it the neuropathic pain I felt. Initially, I had difficulties in doing things as simple as eating and changing clothes. At work, considering the dexterity required for certain tasks, I had to rely heavily on my right hand and the help of others. I also had to take a break from playing tennis for a while and resort to other forms of exercise. Having personally experienced all of these, I was able to appreciate more the value of rehabilitation medicine diagnostics and management. I also had a better understanding with regard to prognosis after the musculoskeletal ultrasound and the nerve conduction study that were done. These tests, along with the functional hand capacity tests done by the occupational therapist, also helped me in objectively monitoring my recovery. I shared these unique perspective and insights in the writing of this paper.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

All authors declared no conflicts of interest.

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