

## Case Report

# A stroke mimicker following inferior alveolar nerve block: a case report

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**Abstract – Introduction:** Local anesthesia administration albeit being the most common dental procedure is associated with complications that usually arise as a result of wrongly placed injections into local or distant sites. Here we present a case of an unexpected complication affecting the upper limb after dental anesthesia administration. **Observation:** A 26-year-old Malay female presented with the left upper extremity paralysis and paraesthesia following the administration of a local anesthesia block to the left inferior alveolar nerve, at a dental teaching center. The onset of the dental nerve block and left upper extremity weakness occurred and eventually subsided. As the provisional diagnosis was either a transient ischaemic attack or stroke, she was immediately referred to the Emergency Department. She was thoroughly assessed and monitored with the neurology team being consulted. Her vital signs remained stable and she showed no neurological deterioration throughout the observation period. She was discharged without further investigations after regaining full strength and sensation of her left upper extremity. The report tries to hypothesize the possible cause of this incident. **Conclusion:** This case highlights the importance of dentists being alert to possible effects of local anesthesia to regions beyond the head and neck area.

## Introduction

The administration of local anesthesia in the oral cavity is a routine procedure in the dental practice. It is given for oral surgery procedures, restorations and root canal therapy and others. Like any other drugs, local anesthesia is not free from complications [1]. This can either be temporary or permanent, and is further classified into local, distant or systemic complications [2].

Localized complications include iatrogenic injection into the inferior alveolar nerve, lingual nerve and/or chorda tympani resulting in prolonged/permanent numbness or pain, and possibly altered taste [3–5]. Complications involving distant sites include facial nerve paralysis when the needle is inserted beyond the pterygomandibular space into the parotid gland. Other distant sites of concern involve the ear [6,7], and eye [8]. Systemic complications that have been reported include isolated atrial fibrillation [9], allergic reaction [1], toxicity, methemoglobinemia [10], status epilepticus with/without stroke [11,12], loss of consciousness [13], and death [14].

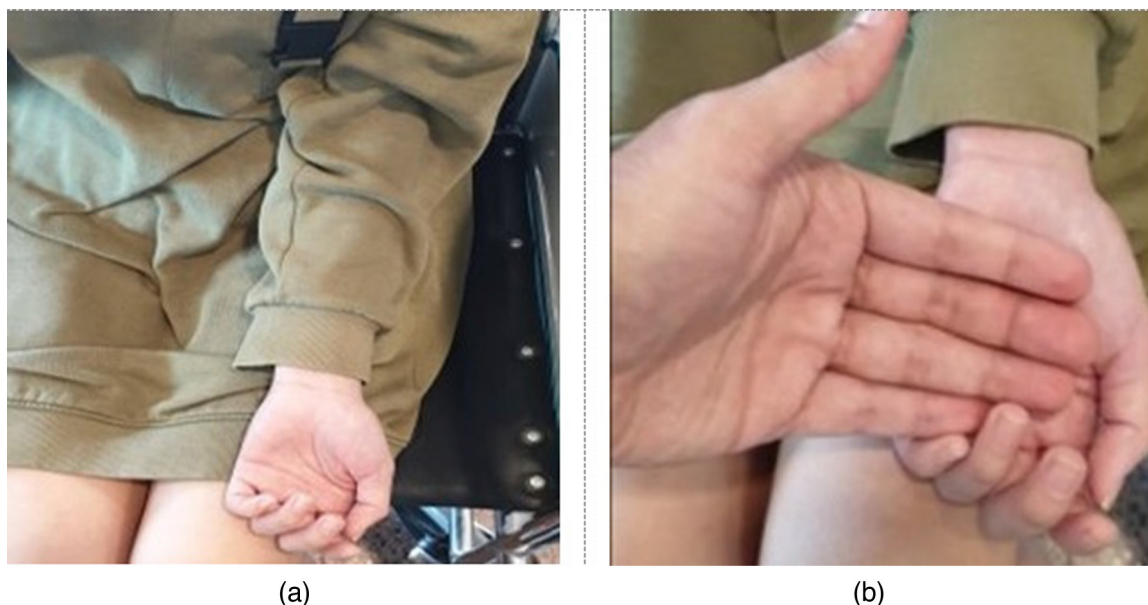
The brachial plexus is a complex neural network that provides somatic motor and sensory innervation to the upper extremity, including the upper chest. If brachial plexus palsy happens, it is often related to childbirth (Erb Palsy). [15]. Brachial plexus

injury in adults is less common and is often associated with trauma, especially motorvehicle accidents [16]; there are also rare occasions that results from clavicular fracture [17]. Injury will cause paralysis or weakness of the upper extremity of the ipsilateral side of the affected brachial plexus. Paralysis or drooped arm is also a pathognomonic sign of stroke. Besides arm paralysis, other signs of stroke include drooped face and speech deficit. In stroke, the contralateral side of the arm is affected [18]. A case of acute ischemic stroke following inferior alveolar nerve block with lidocaine injection has been reported in current literature [12]. This case report presents a case of a patient with an unprecedented complication following the administration of a local anesthesia block to the left inferior alveolar nerve, where she developed a sudden upper extremity paralysis and paraesthesia. With no similar complication published till date, we have discussed possible hypotheses that could possibly explain this rare occurrence.

## Observation

This case involves a 26-year-old Malay female who has mild gastritis but is otherwise fit and healthy. She claims to be a generally anxious person, who has episodes of hyperventilation and occasional spasms over both her upper and lower limbs triggered by stress. She had recently undergone a dental filling on the lower right molar under local anesthesia without any

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**Fig. 1.** The weak left upper limb which the patient (a) failed to lift up and (b) failed to grasp.

**Table I.** Neurological assessment of left upper limb at 1, 4 and 8 hours post administration of local anesthesia (LA).

Left upper limb power assessment	1 hour post LA administration	4 hours post LA administration	8 hours post LA administration
Wrist extension	0/5	4/5	5/5
Wrist flexion	0/5	4/5	5/5
Elbow flexion	0/5	4/5	5/5
Elbow extension	0/5	4/5	5/5
Shoulder abduction	0/5	3/5	5/5
Shoulder adduction	0/5	3/5	5/5

complications. She is currently being treated for root canal treatment of the lower left first molar at the Undergraduate Restorative Clinic, University of Malaya.

On the day of the event, she was anesthetized via a left inferior alveolar nerve block using 1 cartridge (1.8 mL) of local anesthesia containing Lidocaine 2% (1:100,000 adrenaline). About 4 minutes after administration, anesthesia over the entire distribution of the left alveolar nerve was achieved. Unfortunately, about 10 minutes later, the patient complained of numbness and inability to move her entire left upper extremity (Fig. 1).

The authors were called to the scene immediately from the Oral and Maxillofacial Clinic. Upon arrival, preliminary assessment showed that the patient was unable to move the fingers in her left hand and lift her left hand, as claimed. She was able to feel light touch and sharp sensation but had altered sensation over her entire left upper limb. A neurological examination revealed a decrease in strength to grade 0 of the manual muscle testing scale in the muscles innervated by the musculocutaneous, median, and ulnar nerves, whereas those supplied by the axillary and radial nerves appeared unaffected, suggesting medial and lateral cord impairment in the left

brachial plexus. The area of reduced sensation of touch mostly corresponded to the distribution of the median and ulnar nerves.

The patient however, was calm and composed throughout the ordeal and her vital signs were stable. She did not develop any other systemic signs or symptoms. She was then swiftly transported to the Emergency Department of the University Malaya Medical Centre. At the Emergency Department, she was assessed by the Emergency physician. The first step carried out by the physician was to lift the patient's left hand, which revealed increased muscle tone and rigidity. Upon the release of her hand, she was able to maintain a raised position of the arm, but experienced pain over the left shoulder. At the same time, she was also fully alert and able to speak in full sentences without any slurring of speech. Therefore, stroke protocol was not initiated, and the patient was triaged to the semi-critical zone. A full neurological assessment and blood investigation, including full blood count, renal profile, coagulation profile and liver function test was done. The blood results showed no abnormalities. She was also given an immediate dose of tablet acetaminophen 1 gram.



**Fig. 2.** The patient regained full return of power to her left hand 7 hours later with the ability to (a) lift arm and (b) grasp tightly.

Neurological assessment was done hourly on the left upper limb for the first four hours. By then, the patient started to regain normal sensation over the left side of her face (Tab. I).

A full neurological assessment was then repeated, and it showed return of power to her upper limb, although not fully. Her intraoral numbness also wore off at about the same time. No other intervention was made besides monitoring, and she regained full power and sensation in her upper left limb 8 hours after the onset of the event (Fig. 2). She was subsequently discharged home with no further follow-ups. She continues to receive dental treatment without any incidents.

## Discussion

The fast speed of onset with regards to the upper extremity paralysis correlates with those observed in a brachial plexus palsy. As there is no trauma involved, the differential diagnosis made was a potential stroke or a local anesthetic block gone wrong. Other causes such as the rare Parsonage-Turner Syndrome where healthy individuals suffer with sudden unilateral shoulder pain, is unlikely given the lack of pain and fast onset observed in this case [19]. In the primary motor cortex of the brain, there is broad somatotopic representation with the extremities taking up a large portion of it. Adjacent to it is the face, hence the pathognomonic of drooped face and speech deficit if stroke happens. Cases of isolated shoulder palsy or distal arm monoparesis due to stroke, however, have been reported [20,21]. The odds of this patient having a stroke on the dental chair is extremely low given her young age, low BMI and good health. This doubt was cleared by the Emergency physician, and she remains healthy after discharge.

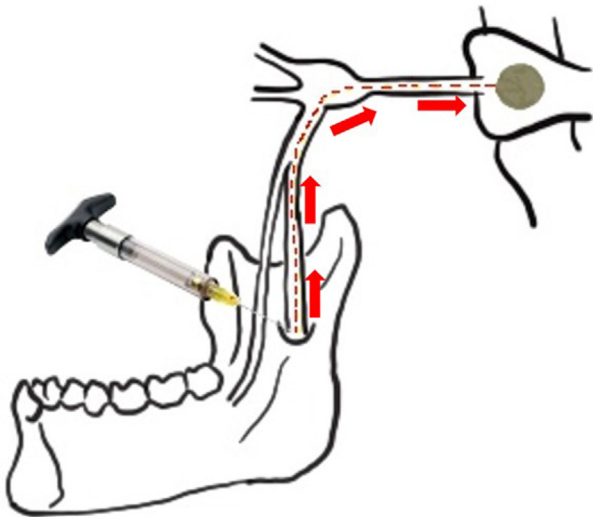
As described in the *Introduction*, there is an array of distant complications that can occur with an inferior alveolar nerve block. However, a literature search found no case of isolated ipsilateral upper extremity paralysis and loss of sensation

following an inferior dental nerve block. The closest case reported is a case of stroke that was preceded with status epilepticus following an inferior alveolar nerve block with lidocaine [12]. The authors postulated that local anesthesia toxicity was the underlying cause affecting this 11-year-old female.

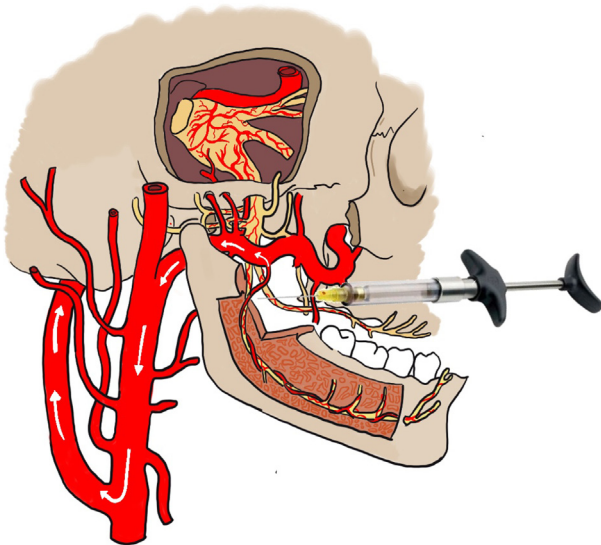
Pertaining to this case, the timing of her signs and symptoms correlates with the onset and duration of the local anaesthesia given, hence suggesting that her symptoms correlate with the inferior alveolar nerve block injection. Local anesthetic systemic toxicity (LAST) has been reported to cause a stroke mimicker [22]. However, given the duration of rapid recovery, toxicity is unlikely in this case. The next question in mind is to hypothesize the route for the local anesthetic agent to reach the brachial plexus or its controlling centre *i.e.* the primary motor cortex of the brain.

A number of cranial nerve nuclei are present in the pons, with those involving the sensory and motor nuclei of the trigeminal nerve located at mid-pons. This area is supplied by the pontine artery which is a branch of the basilar artery. The basilar artery on the other hand, forms the Circle of Willis. One hypothesis we proposed is that local anesthetic agent finds its way to the trigeminal nuclei via retrograde subperineural flow [23], after which it is carried through the pontine artery to the basilar artery (Fig. 3). Because of the Circle of Willis, it is able to reach the contralateral middle cerebral artery to cause effect on the primary motor center that controls the upper extremity [24].

In animal studies, results in both dogs and rhesus monkeys showed that when small amounts of local anesthetic agents were injected into a branch of the external carotid artery, they entered the cerebral circulation through retrograde flow into the common and then internal carotid arteries [25,26]. This leads to our second hypothesis that intravascular injection has inadvertently been administered, with the bolus of local



**Fig. 3.** Schematic diagram showing the flow (arrows) of subperineural spread of local anesthetic agent.



**Fig. 4.** Intravascular spread of local anaesthesia from the inferior alveolar artery towards the carotid arteries.

anesthetic agent being deposited into the inferior alveolar artery finding its way to the middle meningeal artery via a common trunk in the maxillary artery (Fig. 4). The middle meningeal artery has been reported to anastomose with the internal carotid artery [27], thus making it possible for the bolus of local anaesthetic agent to reach as far as the middle cerebral in the same manner described above.

Lastly, although Aldrete and co-workers marshaled considerable evidence to support their “reverse carotid flow” theory, they failed to address the difference between intra-arterial and intravenous injections. Yagiela, on the other hand, found that the intravenous effect of lidocaine injections with or without epinephrine proved to be more than intra-arterial administration, and questioned the value of intra-arterial injections [28]. In accordance with this finding, it can be

hypothesized that the local anesthetic agent injected in the current case was actually deposited into the venous drainage of the retromandibular vein that subsequently found its way to the external jugular vein that communicates with plexus of veins around the vertebral artery and muscles at the base of the neck [29]. Here the effect of the local anesthetic agent became concentrated to the ipsilateral brachial plexus. As our patient is a generally anxious person with a previous history of spasms and hyperventilation triggered by stress, there are several other conditions that may have contributed to her condition. Those conditions include anxiety disorders such as panic attacks, hypochondria and post-traumatic stress disorders and factitious diseases like Munchausen’s syndrome. An unlikely non psychogenic etiology on the other hand can be attributed to malingering. However, we were able to rule out those conditions because of the patient’s calm demeanor throughout the entire tribulation, and from the findings of our neurological examination.

## Conclusion

Unintended intravascular injection from inferior alveolar nerve blocks has been reported to result in distant complications affecting the ear and eyes, and the current case shows that it can be as far as the upper extremity. Although this complication is transient, it is most certainly of concern to both dentists and patients. Immediate referral to the Emergency Medical facility is warranted in such cases and the patient should be monitored thoroughly before discharge.

## Conflict of interest

The authors declare no conflict of interest.

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## Ethical approval

While ethics approval is not applicable in this case report, the principles outlined in the Declaration of Helsinki were strictly followed throughout the entire process to ensure that the authors acted in the patient’s best interest when providing medical care while adhering to the ethical guidelines.

## Informed consent

Written informed consent for patient information and images to be published was provided by the patient.

## Authors contributions

Muhammad Kamil Hassan: Writing original draft, reviewing and editing, Namkabr Singh: Reporting the incident, reviewing

and editing, follow-up with the patient, Kalpana Selvaraju: Reporting the incident, reviewing and editing, follow-up with the patient, Ngeow Wei Cheong: Conceptualization, drafting of manuscript, reviewing and editing.

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