

## Legal Implication of Nerve Injuries Induced by Phlebotomy

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### Background

Although venipuncture is ordinarily a routine, low-risk procedure, and injuries to the peripheral nerves that cross the cubital fossa have rarely been reported, they are sometimes the subject of compensation claims from patients who complain of having suffered this type of damage. There is no lack of judgements in civil law in which the resulting outcomes are contested, for example the positioning of a cannula needle, inter alia without informing the patient of potential risks (Court of Cassino, Judgement 09/08/2016). A dated Supreme Court judgement (No. 32553 of 25/08/2005) already observed that taking blood samples from the vein, albeit a routine practice, is nonetheless an invasive procedure which can cause the patient harm if not performed by professionally prepared practitioners and following precise techniques and methodologies.

We present two cases of peripheral nerve injury occurring during phlebotomy, for blood donation and for diagnostic use, which led to a claim for compensation from our healthcare authority for the damage suffered. In both cases, the diagnosis was suspected due to the sudden emergence of pain, of a shock type, radiating to the forearm, and was confirmed by electrodiagnostic studies. Doctors and nurses must be aware of this risk, including on the medico-legal side, comply with the standards required for phlebotomy, ensure sufficient training, acquire adequate experience in the procedure and document anomalies in the process and informed consent.

### Cases Presentation

**Case 1:** A regular blood donor, on the occasion of the puncture for his donation, has complained about a sudden pain with irradiation ulnar side down to the wrist. These disorders, albeit mitigated, persisted despite treatments applied immediately (ice).

Local objectivity was described as a normal, in particular not detectable swelling, or signs of inflammation, etc. An ultrasound

exam (US) and an MRI on the left elbow and forearm showed no alterations. An electroneuromyography (EMNG), performed after two months, showed "small reduction of Sensory action potentials (SAP) of the left ulnar nerve then the right, and a modest reduction in conduction in the stretch through the elbow". This test was repeated after six months and was completely normal. Nevertheless, the donor was still complaining of "discomfort on the left arm" characterised by sensory disorders in the area of the nerve. Because of this, he called for substantial compensation.

**Case 2:** A patient was undergoing venipuncture for preoperative assessment. During needle penetration, he complained of acute pain, like an electric shock propagated to the entire forearm. He accused immediately inability to flex the distal phalanx of the thumb. The motility of the fingers was kept. The site of venipuncture was normal, in particular not detectable swelling, or signs of inflammation, etc. EMNG, performed after a month, recorded acute partial denervation of the flexor thumb. Diagnosis of anterior interosseous-nerve syndrome was made by a neurologist. In the following months, the patient's symptoms regressed progressively. However, upon follow up 6-months late there was still a reduction by 50 % in strength flexion of F1 over F2. EMNG indicated chronic neurogenic suffering of the right flexor pollicis longus muscle. As a consequence, the patient asked to be compensated.

### Discussion

Many complications may go hand in hand with venipuncture or intravenous cannulation in the antecubital fossa. Among these, nerve damage is potentially serious as it can lead to numbness, deformity and lifelong paralysis. Particularly, the commonly used superficial veins in the upper extremity lie directly over the medial or lateral antebrachial nerve and the anterior interosseous nerve [1-16]. Radial nerve injury, though extremely rare, has been also reported [6].

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The median cutaneous antebrachial nerve is a sensitive nerve which runs close to the basilic vein above the medial epicondyle of the humerus. This nerve provides sensitivity to the medial forearm. The lateral cutaneous antebrachial nerve is the distal sensory extension of the musculocutaneous nerve piercing the deep fascia and emerging from underneath the lateral aspect of the biceps tendon at the level of interepicondylar line. This nerve supplies the skin over the lateral forearm.

Injuries to those nerves can cause, respectively, loss of sensation of the skin overlying medially or laterally. Instead, the anterior interosseous nerve is a branch of the median nerve. It supplies the flexor digitorum profundus for the index and middle and the flexor pollicis longus. His lesion is characterized by pain in the proximal forearm and weakness of flexion of the distal joint of the thumb and of the index so that the patient is unable to effectively pinch the thumb and the index together (pinch or circle sign).

The reported overall incidence of upper limb nerve injuries following blood donation or routine venipuncture is rare. Some studies on blood donors report an incidence ranging from 1/1.400 to 1/6.300. Nevertheless, it can be underestimated due to under reporting, underrecognition and underdiagnosis [1, 5, 15-18]. Several mechanisms are associated with injection-related nerve injury; direct needle trauma, toxic effects of injected agents on nerve fibres and surrounding tissues, nerve compression due to hematoma or oedema formation, and so on. Among them, direct needle trauma is the most frequent factor.

Symptoms included immediate radiating, often 'electrical' sharp shooting pain moving away from the venipuncture site are associated with direct nerve injury while, paraesthesias such as tingling, burning sensations in the forearm, hand, wrist distant from the venipuncture site are associated with nerve irritation by a hematoma or swelling. Rarely, weakness of the arm may develop. In the vast majority of cases, patients recover after a few days and a minority of them within a few months. The risk of permanent nerve injury (more than six months) is very rare. Often patients can experience a slight, local paraesthesia. Exceptionally cases of permanent, progressive, and painful disability resulting in reflex sympathetic dystrophy (RSD) or complex regional pain syndrome (CRPS) can result. Data from the literature show that nerve injuries from venepuncture make a recovery of 70, 90 and 96 percent within 1,3 and 6 months respectively [1]. A total recovery happened in most of the cases. In our experience we noticed that EMNG abnormalities eventually resolved within a few months.

Those injuries are mainly caused because nerves in the antecubital fossa lied just below or close to the veins (basilic, cephalic or median cubital vein). This area of the body carries a higher risk of hitting or damaging nerves than others. Additionally, studies on cadaver's upper extremities show that some cutaneous nerves' major branches can lie also superficially, partially overlapping or extremely tight to the veins [8]. Finally, the medial antebrachial cutaneous nerve is a branch of the brachial plexus with a great variation within its branches. By consequence, even though a correct and proper venepuncture technique has been performed, it is still unintentionally possible to damage those nerves [7].

In our two cases, at the time of the procedure, difficulties (e.g., multiple attempts), traumatic or septic phlebotomy has not been reported. In Newman' cases 24% of the patients experienced a certain degree of trauma (e.g., hematoma) but in the vast majority, a hematoma was absent.

Cases presented by Horowitz were most severe, with a more frequency of hematoma and a worst prognosis. Complaining of shooting pain immediately after needle insertion is suggestive of direct nerve injury, but a hematoma could be responsible, indirectly, of nerve compression and continuous pain and dysfunction. On the medico-legal side, due to the anatomical variability and because the deeper side of the vein and superficial side of the sensory nervous branches are very close to each other, the risk of damaging a nerve accidentally is a constant risk, even if the vein is not transpierced at site where the nerve and vein intersect and by adopting a proper technique. Doctors and nurses, however, must be aware of this risk to guarantee early identification and management, limit and prevent chronicity, and discourage legal measures.

In terms of documentation, although the incidence of nerve injuries induced by phlebotomy is infrequent, any aspect of care delivered to patients requires their consent, with appropriate and supported information about this adverse event. When the most favorable vein is not available, it is important to motivate a second choice, with adherence to what is regarded as a "best practice". The veins of choice for cannulation include the cephalic or basilic veins, followed by the dorsal venous network. Recording of a number of attempts, trauma, pain or disturbed sensations is essential. An appropriate technique implies that the angle of the needle entry into the skin is between 5 and 15 degrees, avoiding multiple attempts and puncturing the posterior wall of the vein. If venous catheterization is unsuccessful, the needle should never be reintroduced into the catheter. It is also recommended to use a nondominant hand. If the patient complains of a sharp pain shooting up the arm or ongoing numbness or tingling of the extremity, the cannula should be removed immediately. In case of hematoma or symptoms suggesting nerve damage, the patient must be closely monitored in order to ensure prompt diagnosis and treatment.

### Conclusion

Venipuncture-related nerve injuries in the antecubital fossa are infrequent and symptoms are usually slight and transient. Although, sometimes, those injuries can irreversibly cause loss of sensation and function throughout the arm. They led to a claim for compensation, as well. To manage risks and claims prevention, phlebotomists must be familiar with anatomy, use a proper venipuncture technique, and choose a venipuncture location carefully. Along with the acquisition of inform consent, it is also advocated to document the happening of and around the venipuncture, occurrences, and anomalies in the process [9].

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