

## Case Report

# The Development of Acute Radial Nerve Palsy Following General Anaesthesia: A Case Report of a Manual Worker

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- General anesthesia
- Heavy manual work
- Automatic blood pressure monitor

## Abstract

Acute radial nerve paralysis developed following general anaesthesia for tympanoplasty surgery in a 22-year old male with a 4-year history of manual work. Standard pads were used under the extremities and the patient position was changed at intervals. Preoperatively and postoperatively, no intervention such as intravenous or intramuscular injection was made to the right arm. Only the automatic blood pressure device cuff was attached. In this patient was considered to be a case of radial paralysis caused by hypertrophy as a result of excessive use of the arm muscles, and the radial nerve, having been previously relatively compressed was under increased compression between the muscles as the cuff of the automatic blood pressure device regularly inflated affecting the vasa nervorum and therefore the nerve remained in hypoxia resulting in the development of paralysis. Especially in patients who have to use the arm muscles excessively in work or sport, to overcome the risk of partial nerve compression because of muscle hypertrophy, the use of an FDA approved automatic blood pressure device without a cuff is recommended during general anaesthesia.

## INTRODUCTION

Perioperative peripheral nerve paralysis during general anaesthesia is an uncommon event (0.4%) [1]. Paralysis is most often seen in the ulnar nerve and because of the topography, radial nerve paralysis is more rarely seen [2]. The nerve may be directly injured by injection or sutures and indirectly by events such as straining the arm or compression [3,4].

There are some predisposing factors for radial nerve paralysis. These include diabetes mellitus (DM), hypovolemia, dehydration, hypothermia, peripheral neuropathy and the patient being underweight [5]. There are studies which have reported that radial nerve palsy has developed with partial compression or the mass effect of muscle hypertrophy which has developed as a result of excessive use of the arm muscles [6,7]. Nerve conduction velocity tests provide an understanding of the integrity of the nerve. Electromyography aids the understanding of the location of the lesion and whether the paralysis is acute or chronic [8]. In the treatment of radial nerve palsy, the use of a splint is recommended to prevent contractures and physical therapy to prevent muscle atrophy [4].

## CASE PRESENTATION

A 22-year old male who smoked cigarettes had worked for

4 years in drinking water delivery, carrying 19lt demijohns of water. He was admitted to hospital for tympanoplasty surgery because of chronic otitis media in the left ear. In the clinical examination, there was a 3-4mm perforation in the left ear membrane. In the audiological tests, there was 30dB conductive hearing loss. Preoperative blood tests and physical examination results were normal and there was no history of any other chronic disease or familial peripheral neuropathy. The patient was laid in a supine position on a standard soft padded operating table. As standard practice, a soft cloth was placed under the extremities. The right arm of the patient was attached to an arm-rest in approximately 60° abduction and the left arm was parallel next to the body. The head was turned to the right at 45°. Preoperatively, during the operation and postoperatively, no intervention such as intravenous or intramuscular injection was made to the right arm. Only the automatic blood pressure device cuff was attached. The operation lasted approximately 120 mins. Throughout the operation, nitrous oxide, isoflurane, propofol, norcuron, neostigmine methyl sulphate, adrenaline and pheniramine were administered.

As soon as the patient awakened after the operation, he complained that he could not move his right hand. In the physical examination, drop hand was determined on the right side. There

were no findings of hyperemia, oedema, ecchymosis or signs on the skin of the arm, forearm or hand which would suggest direct trauma. With a diagnosis of acute radial nerve palsy, emergency consultation was requested from a neurologist and physical therapy specialist. The extensor muscle power of the wrist and fingers was 0/5. There was sensory loss in the thumb of the right hand. No pathology was determined on computed tomography brain imaging. Physical therapy was started immediately. Range of motion (ROM) exercises, occupational therapy, working therapy, transcutaneous electrical nerve stimulation, progressive resistive exercises, fluidotherapy and ultrasound were applied. A splint was applied to prevent contractures. After the patient was discharged, regular physical therapy was continued.

The first EMG test and nerve conduction velocity test were applied on the 15th day. The EMG findings of the triceps muscle and ulnar, median and musculocutaneous nerve conduction velocities were normal. Conduction was blocked in the radial nerve at the middle part of the right arm (the section before the superficial sensorial branch) and below this level, denervation was determined in the muscles which innervate the radial nerve. On the 57th day, there was no movement, not even minimal, in the wrist and fingers and the sensory loss in the thumb had recovered. On EMG, neurogenic motor unit action potential (MUAP) changes and occasionally fibrillation were observed in the muscles which innervated after providing the sensory branch of the radial nerve. The radial nerve motor conduction velocity was 55.9 m/sec and the amplitude was low (6.7 mV). When these findings were compared with the previous EMG, a partial recovery was seen towards the distal of the nerve. The patient could not use his right hand and 3 months postoperatively lost his job. After 6 months, minimal movements started to be observed in the extensor muscles of the wrist and fingers and at 9 months there was full recovery.

## DISCUSSION

Peripheral nerve injuries are a significant cause of morbidity for the patient. As in the case presented here, it may lead to loss of employment. Of peripheral nerve injuries during general anaesthesia, ulnar nerve injuries are most often seen [1]. Etiological factors include compression, strain and ischaemia and direct trauma such as injection or suture. Radial nerve injuries due to compression are seen less frequently compared to the ulnar nerve because the radial nerve passes through a deeper area [2]. Predisposing factors have been defined as local causes such as cyst or tumour, systemic causes such as hypoxia, dehydration or hypothermia and DM, congenital anomalies, hereditary neuropathy or the patient being underweight [3]. In previous studies, acute or progressive radial nerve paralysis has been reported associated with compression of the triceps, brachialis muscle and brachioradialis muscle with hypertrophy resulting from muscular effort or excessive use of the arm muscles [5-7]. In several studies, radial nerve paralysis has been reported because of compression from the cuff of the automatic blood pressure device used to measure blood pressure during general anaesthesia [2,9]. In paralysis due to the mechanical effect of the blood pressure device cuff, the patient generally has complaints of pain in the arm and in the physical examination, hyperemia, oedema and marks on the skin are observed. Oedema has even

been determined in the hand [9]. However, these findings were not present in the current case.

In the current case there were no local causes such as cyst or tumour or any predisposing systemic causes such as hypotension or hypoxia. Standard pads were used under the extremities and the patient position was changed at intervals. In the postoperative physical examination, radial paralysis was seen to have developed in the right arm and there were no physical findings such as hyperemia, ecchymosis or oedema in the forearm or hand which would suggest direct or indirect trauma. If there had been an association with compression, these findings would have been seen on the skin of the arm. No procedure was applied to the right arm pre or postoperatively. Only the automatic blood pressure device was attached to the right arm and it was functioning correctly.

Isolated radial paralysis has not been reported associated with anaesthetic drugs. In the current patient, apart from carrying heavy weights by hand, there was nothing remarkable in his history. In cases of muscle hypertrophy, the paralysis location is in the mid-section of the arm after the radial nerve has branched into the triceps muscle [9]. This is supported by the location of the lesion in the current case, as determined by the EMG findings and the nerve conduction velocity tests. Therefore, this patient was considered to be a case of radial paralysis caused by hypertrophy as a result of excessive use of the arm muscles, and the radial nerve, having been previously relatively compressed was under increased compression between the muscles as the cuff of the automatic blood pressure device regularly inflated affecting the vaso nervorum and therefore the nerve remained in hypoxia resulting in the development of paralysis.

Especially in patients who have to use the arm muscles excessively in work or sport, to overcome the risk of partial nerve compression because of muscle hypertrophy, the use of an FDA approved automatic blood pressure device without a cuff is recommended during general anaesthesia. In addition, as there may be a lengthy recovery period from the paralysis, as in the case presented here, physical therapy must be applied carefully and continued with patience to prevent muscle atrophy and contractures.

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