

CASE REPORT

REGIONAL ANESTHESIA

Tourniquet palsy in upper limb; a case report

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Abstract

Corrective surgical procedures especially on the limbs take much time to finish and need intense vigilance. During these surgeries tourniquet application is common to prevent excessive blood loss and to perform the procedure in a bloodless field. However, tourniquets have been known to cause some complications due to nerve compression needing immediate attention. We present a case of tourniquet palsy in upper limb with involvement of radial, ulnar and median nerve. The patient received physiotherapy treatment which lead towards his speedy recovery and prevented him from disabilities.

Key words: Tourniquet palsy; Nerve injury; Physiotherapy; Neurodynamics

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1. Introduction

A device used to limit the flow of blood to the distal part of a limb, such as an arm or leg, is termed as a tourniquet.¹ A tourniquet may have different effects on a limb when used during surgical procedures, as a result of pressure at the site of the cuff and the resultant ischemia distal to the point of application.² Pneumatic tourniquets were first introduced by Harvey Cushing in 1904, and have been widely used in surgical procedures on extremities to attain a bloodless operative field. However, even when properly used and controlled, both local and systemic complications can occur.^{3,4}

Hidou M et al. studied a 51-year-old ASA I case, who underwent an axillary block for hand surgery/ by using 50 ml of 1% mepivacaine. Tourniquet was applied for 45 min at a pressure of 300 mmHg. Patient's limb remained numb on that day even after several hours. On electrophysiological testing severe conduction block was witnessed in sensory and motor fibers. After 2 months, epineurotomy had to be

performed to rule out median nerve compression in brachial canal.⁵ The radial nerve injury has been reported in a study conducted at Peshawar in open reduction internal fixation (ORIF) of shaft of humerus in 4 out of 41 patients apparently due to tourniquet use.⁶

Tourniquet palsy is one of the uncommon complications of orthopedic surgery and only few cases have been reported from Pakistan up till now. This case report will provide evidence about its occurrence and alert for the anesthetists and the orthopedic surgeons to be more careful and take preventive measures.

2. Case Report

A 28 years old male patient was referred to physical therapy department diagnosed as tourniquet palsy. He was in usual state of health when he met a road traffic accident (RTA) and got multiple fractures of right humerus, radius and ulna. He was transported to the

local public sector hospital. ORIF was done in next 12 hours to fix the fractured bones. He was

discharged from the hospital the very next day. After a couple of days, he felt weakness and numbness in his right upper extremity.



Figure 1: Right wrist and hand of the patient before treatment depicting wrist drop.

An orthopedic surgeon removed the metallic implants, and referred him to physiotherapy department. On examination his right ulnar, median and radial nerves were found affected. There was sensory loss, weak reflexes and motor weakness in the distribution of these nerves. A QuickDASH score was found 88.6/100 on his first visit.

An aggressive physiotherapy treatment including electric stimulation, passive range of motion (ROM) exercises, neuromobilization and support was started for six days a week. Treatment continued for eight weeks and significant progress was observed in terms of improvement of the symptoms. A very unique observation was that whenever electric stimulation was applied to the muscles of palm, patient had an uncontrolled tummy laugh for 2-3 min. The mechanism is unknown.

Table 1 shows results of nerve conduction studies of Radial, Ulnar and Median nerves. NCS was conducted before the starting physiotherapy treatment and after 12 weeks of treatment. There was significant difference in speed of nerve conduction velocity NCS measured in meter per seconds (m/s) and distal latency DL measured in milliseconds (ms) in all three peripheral nerves of right upper extremity.

The patient progressed day by day and after 8 weeks his QuickDASH score was found to be 27.3/100. There was significant improvement in his disability as seen by the NCS after the therapy (Table 1). The patient was given a home programme and advised to visit once a week for next three weeks for follow up.

3. Discussion

In 1904 Harvey Cushing introduced the concept of pneumatic tourniquet and now a days it is widely being used in orthopedic surgeries. When Esmarch bandage was used as a tourniquet the morbidity was high, but with the availability of pneumatic tourniquets in the operating rooms, and high precision in surgical procedures, the morbidity rate has reduced. Although the complications have been reduced but still there is a chance of nerve damage with the use of tourniquet resulting in paralysis.⁷ In contrast to a study conducted in 1983 which concluded that nerve lesion was caused by excessive direct pressure from tourniquet, our case study concluded that paralysis of the patient's limb was due to prolong application of the tourniquet.⁸ In another study, 63484 operations were performed using tourniquet by 265 Norwegian orthopedic surgeons working at 71 different institutions over a period of almost 2 years. According to the guidelines used by them, they applied tourniquet that was left on for 2 h

Level/ Sight of assessment	Time of assessment	Ulnar Nerve		Radial Nerve		Median Nerve	
		Dist. Latency (ms)	NCV (m/s)	Dist. Latency (ms)	NCV (m/s)	Dist. Latency (ms)	NCV (m/s)
Axilla	Pre	3.0	57.7	3.1	54.6	2.9	49.8
	Post	3.1	61.5	3.3	59.5	3.1	54.7
Above Elbow	Pre	2.1	39.2	2.3	33.2	2.4	22.9
	Post	3.0	60.7	3.1	58.7	3.0	53.9
Below Elbow	Pre	1.4	14.1	0.9	14.1	1.1	12.1
	Post	2.6	58.2	2.8	57.9	2.9	51.8
Wrist	Pre	0.7	11.3	0.6	10.3	0.7	10.2
	Post	2.6	57.9	2.7	56.8	2.8	50.3

and can be reapplied after 15 min. 26 complications were reported, out of which 15 were neurological; 3 were in the upper limb and 12 in the lower limb. Out of the 15 cases, 2 were permanent but the rest of them resolved within 6 months.⁷

In 1983 a study was conducted in which a man in his 30's had an amputation of index finger and was presented with paresis and sensory deficits in left arm, his surgery was performed using pneumatic tourniquet in a bloodless field. The nerve lesion was caused by direct pressure from the tourniquet. The sensory deficit took eight weeks to recover, whereas paresis took twenty three weeks. The rule was to inflate the tourniquet up to 250 mmHg, but it was inflated up to 500 mmHg due to faulty gauge. So to avoid such complications gauges should be checked beforehand.⁸ A study on ischemic effects of various forms of external and internal pressure was conducted with the objective to identify ischemic conditions of muscles and nerves and assist in the treatment. The researchers concluded that while using pneumatic tourniquet, one must make sure that the pressure is maintained to a maximum limit of 300 mmHg or 5 pound per square inches, while during surgical operations using tourniquet make sure that the exposed tissues are kept moist and cool using sterile saline solution. As tissues are subjected to prolonged ischemia we should be aware of possible deleterious effects on all tissues; the duration for the application of the tourniquet should be kept as short as is consistent with the nature and difficulty of the particular operation. Approximate maximum tourniquet time is about three hours without any complications. If the peripheral arterial pulse is absent, take immediate steps to relieve pressure on a main artery.⁹

In routine surgeries of upper limb, 1 in 7000 patients suffered from tourniquet palsy with symptoms below elbow involving all three nerves supplying the forearm and the hand.¹⁰

A case study of 51-year-old ASA I patient was reported by Hidou M, et al. They found that a pressure of 200 mmHg is sufficient to provide a bloodless field. A tourniquet must be applied on a diaphysis and not on bony relief. Our case study concluded that paralysis of the patient's limb was due to prolonged application of tourniquet.⁵

Patients with congenital susceptibility to nerve compression and with systemic lupus erythematosus

(SLE) should be considered unfit for the use of tourniquet and care should be taken in patients with underlying coagulation disorders and neuropathies.¹⁰ In a case report, Sahin et al. reported ulnar nerve and ulnar artery injury in a 56 years old male patient having comminuted fracture of distal radius in an RTA. The ulnar nerve was found trapped in the scar and was surgically released.¹¹

Mechanical pressure imparted on nerve by the tourniquet may lead towards the development of tourniquet palsy; adequate knowledge and training of the OT staff can help in prevention of such complications.¹² The application of the tourniquet should be kept as short as is consistent with the nature and difficulty of the particular operation.⁹

Most of the palsy patients recover to a variable extent by expert physiotherapy, which needs to be started as soon as nerve conduction studies in the effected limb confirms nerve damage. It will prevent life-long disability and help early return to work.

4. Conclusion

Tourniquet palsy is an uncommon complication of surgery. Physiotherapy is one of the treatments of choice for full recovery, prevention of disability and early return to work.

5. Conflict of Interest

None.

6. Authors' contribution

WP: Manuscript Drafting and Editing.

IA: Final approval

SA: Data Collection

RH: Conception and Design.

MAA: Manuscript Drafting and Editing

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