

# Missile Injury of Peripheral Nerve Leading to Complicated Irritative Nerve Lesions

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**In 1979 we diagnosed and treated 141 cases of missile injury of peripheral nerve, 22 cases of which (15.6%) complicated by severe causalgia have been reported. In the following page we are going to report on the 44 cases complicated by the irritative neuralgia.**

## CLINICAL DATA

44 cases, all male, ranging from 18 to 37 years old. 27 cases are bullet wound, 15 cases are bomb wound and 2 cases are unknown. 50 nerves of the 44 cases are injured (see table 1).

There are 5 cases whose ulnar nerve and median are both injured and one case whose median and radial nerve were injured. And all the cases concerning the injury of median nerve are causalgia. 32 cases (38 nerves) were operated upon respectively one to five months after injury. The type of injury and treatment with operative microscope are shown in table 2.

The results of reexamination (29 cases, 35 nerves) two years after operation are shown in table 3 (there is 1 case out of 29 cases whose median nerve and ulnar nerve are both injured). The rate of excellent and good is 82.8%.

## DISCUSSION

Causalgia is caused by injury of peripheral nerve has been paid great attention and studied in western countries for a long

time. Several hypotheses have been put forward. Untill now, there has not been a generally acknowledged name for irritative neuralgia. In 1927, Foerster first used irritative neuralgia. In 1947, Kolmer and Budinger used it to describe pain syndrome which was not causalgia. Seddon divided it into two groups: (1) causalgia; (2) irritative neuralgia, including painful digital nerve injuries, painful amputation stumps and painful phantom limbs. Here is the clinical manifestation of irritative neuralgia.

## Symptoms and Signs

The hyperpathia in the areas controlling the injured nerves: A gentle touch on a small part of affected area would cause a violently disagreeable response. However, an abrupt touch on a large part of the affected area, such as a tight grasp on the affected hand or foot, would not cause such a response. That is superficial pain. There are 40 cases in the group. The deep pain group has only 4 cases, of which 3 cases are brachial plexus nerve injury, one case is sciatic nerve injury. It is described as a dullache, crushed or burning pain and

**Table 1. 44 cases (50 nerves) of irritative nerve lesion**

Nerve	Operation	Non-operation	Total
Brachial plexus	4	0	4
Radial n.	2	3	5
Median n.	7	2	9
Ulnar n.	10	3	13
Femoral n.	0	2	2
Sciatic n.	7	1	8
Tibial n.	4	1	5
Common Peroneal n.	4	0	4
Total	38	12	50

**Table 2. 32 cases (38 nerves) of injury and operative procedure**

Injury types	Interfunicular neurolysis	Interfunicular neuroanastomosis	Interfunicular nerve-grafting	Total
Adhesion	21			21
Partial injury		1	4	5
Complete injury		2	10	12
Total	21	3	14	38

**Table 3. 30 cases (35 nerves) follow-up results**

Nerve	Excellent	Good	Fair	Poor	Total
Brachial plexus	3				3
Radial n.	1	1			2
Median n.	4	2	1		7
Ulnar n.	6	2	1		9
Sciatic n.	3	2		1	6
Tibial n.	3	1			4
Common Peroneal n.	1		3		4
Total	21	8	5	1	35

Standard : Pain, hyperaesthesia and Tinel's sign

Excellent : disappeared

Good : not so obvious

Fair : bearable

Poor : no change

becomes worse when weather changes. It is only a kind of slight dullache when the patient's attention is held by work or by pleasant diversion. Tinel's sign is positive at the injured part. The irritative neuralgia genesis rate (31.2%) is higher than causalgia (15.6%). It may affect any peripheral nerve (see table 1). Yet causalgia may affect median nerve or the proximal sciatic nerve or brachial plexus. The deep pain or the superficial pain is not so severe as causalgia. Stimuli of normal contralateral or ipsilateral limb or sudden lightness, noise or emotional pressure can not cause this pain. And there are no obvious changes of skin, finger nails (or toe nails), skeleton or arthrosclerosis on the injured part.

### Causes

According to our operations and observations under operative microscope in 32 cases (38 nerves), we found 3 kinds of nerve injuries (see table 2). But they are not completely the same as the causes of irritative neuralgia though they are directly related with them. Epineural or intraneural adhesion and neuroma are the two main causes.

High speed projectiles such as bullets or bombs are very destructive to the organism. They injure the peripheral tissues of the nerve as well as the nerve. Even if the nerve keeps its continuity, the injury of its peripheral tissues still causes intraneural or epineural adhesion and nervopathy made by the compression of scar for instance, 3 cases of injury of brachial plexus nerve are in the group. After the epineural and interfunicular neurolysis and scar, the nerve recovers its functions and the deep pain disappears. In a case of irritative neuralgia on the sciatic nerve, a metal foreign body which was the size of a grain of rice was found under the epineurium of sciatic nerve in the thigh. The epineurium around the foreign body

thickened and the nerve had interfascicular adhesion. After the extirpation of the foreign body, the interfascicular neurolysis and the removal of the thickened epineurium, the superficial pain disappeared. A case of injury of Sciatic nerve in the hip, had irritative neuralgia on the Tibial nerve which lacked 10 cm, and the Common Peroneal nerve lacked 12 cm. As the proximal adhesion had reached the pelvis and the interfascicular neurolysis and removal of neuromas were not complete, the superficial pain remained after the interfascicular nerve-grafting. The cases mentioned above show that one of the cause of irritative neuralgia is epineural and intraneural adhesion.

After injury of the whole or part of the nerve, the neuroma occurred at the stump of the injury nerve, which may also cause irritative neuralgia of the injured nerve. For instance we had a case of penetrating bullet wound in the ankle and metatarsal bones which caused the irritative neuralgia due to the complete injury of Tibialis Posterior nerve. Satisfactory results were achieved after complete removal of neuroma on the stump, the injured nerve 10 cm and scar around the nerve and the interfascicular nerve-grafting of contralateral Sural nerve. In this group, every injury of the whole or part of the nerve resulted in neuroma on the residual extremities. After removal of neuroma, interfascicular neuroanastomosis or interfascicular nerve-grafting, the irritative neuralgia dispelled or improved. That shows that neuroma is also one of the causes of irritative neuralgia.

### Treatment

In Seddon's opinion, there was no specific medicine for the treatment of irritative neuralgia, the patient often improved or remitted spontaneously. A suitable shoe-pad can remove irritative neuralgia of Sciatic nerve or Tibialis Posterior nerve from indisposition

and pain and enable the patient to bear weight and walk. Operation, examination, removal of foreign body, burial of nerve, neuroanastomosis and removal of nerve are also specific method of treating irritative neuralgia.

This group was observed after injury for three to five months. We used the technique of microscopic surgery to operate on those patients whose symptoms and signs remained unchanged to repair their nerves. The method of operations were neurolysis, removal of neuroma, injured nerve fasciculus, fasciculus groups or the whole nerve and then interfascicular neuroanastomosis or nerve-grafting according to the deficiency of the nerve.

Seddon thought that neurolysis disappointed. The experiences in this group prove that neurolysis efficacy is determined when the nerve after neurolysis is put on the normal tissue base. The "normal" case to the naked eye may show interfascicular adhesion and cicatrital tissues, which must be removed. After neurolysis the nerve must be put in normal muscle tissue or subcutaneous fat instead of putting in cicatrital tissues or on the fibrosis muscle, fat or fascia. The operative hemostasis should be thorough to prevent post-

operative hemorrhage, oozing of blood or hematoma in order to avoid the postoperative recurrence of epineural or intraneural adhesion.

We maintain that interfascicular neuroanastomosis or interfascicular nerve-grafting under operative microscope can make nerve fasciculus accurately coincident and avoid the inversion of fascicular membrane or the exposure of nerve fasciculus. The inversion of fascicular membrane can hinder growth of the nerve axon. The exposure of nerve can make the regenerated nerve axon unable to reach the tunica intima canal of the nerve in far extremity and neuroma may occur near the place of neuroanastomosis. Thus the pain may recur.

We do not adopt simple removal of nerve to relieve the patient of his pain because of two reasons. First, the nerve will lose the abilities of motion and sensation. Secondly, after removal of the nerve, neuroma will surely be formed at the residual extremities or there will appear the necrosis of neurocyte and the fibrosis of nerve axon which will cause the pain to recur. That point has been proved by many people's experiences.

#### REFERENCES

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