

# The Newcastle upon Tyne Hospitals NHS Foundation Trust

## Management of Suspected Nerve Injury after Peripheral Nerve Block

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### 1 Introduction

- Nerve injury is recognized as a potential complication of regional nerve block, but fortunately, severe or disabling injuries are rare.
- Most symptoms of nerve injury usually resolve in 4-6 weeks in over 95% of patients, and in 99% of the patients by one year.
- It is important to develop a plan for recognition, diagnosis, and treatment of nerve injury (Urban and Urquart.1994. Borgeat et al, 2001)



### 2 Mechanisms of Nerve Injury

Neurologic deficits after nerve blocks may be related to vascular injuries, compression, traumatic nerve injury with fascicular disruption, or local anaesthetic effect.

#### 2.1 Vascular Injury

This occurs early in the postoperative period (i.e. minutes to hours). It is commonly caused by a hematoma at the surgical or block site, disruption of blood supply, or DVT.

#### 2.2 Compression Injuries

This usually presents as a focal neuropathy. The following can cause it:

- Expanding hematoma.
- Limb tourniquet/casts or compartment syndromes.
- Improper intraoperative positioning.

- Increased endoneural fluid pressure after nerve block.
- Trauma and surgery.

### 2.3 LA action

Action of local anaesthetics such as Bupivacaine or Ropivacaine may last up to 24 hours. Intraneural injections of local anaesthetics (especially when additives are included) may result in a block, which lasts up to 48 hours.

### 2.4 Traumatic/Toxic nerve injury

This is caused by the following:

- Direct needle trauma: Frequency of nerve injury is greater with long bevelled needles, but the duration and severity is greater with short bevelled needles.
- Intraneural injections: This will increase the pressure inside the nerve which may result in nerve damage.
- Local anaesthetic neurotoxicity: All local anaesthetics are potentially neurotoxic. Vasoconstrictive additives can affect neural blood supply and may potentiate nerve injury.

Confounding Factors: Pre-existing neuropathies (e.g. DM), Demyelinating diseases (e.g. MS), and peripheral vascular disease may make peripheral nerves more susceptible to injury. (Gadsden, 2013) ( Watson and Huntoon, 2015)

## 3 Types of neuronal injuries

### 3.1 Neuropraxia

Mild insults in which the axons and the supporting connective tissue structure supporting them remain intact. Complete recovery expected within weeks to months.

### 3.2 Axonotmesis

An intermediate injury in which there is axonal interruption with conservation of the neural connective tissue. Recovery is generally favourable although not always complete.

### 3.3 Neurotmesis

This represents complete fascicular disruption. Even with prompt surgical intervention, recovery is often poor. (Watson and Huntoon, 2015)

## 4 Assessment of nerve injury

**History:** Symptoms usually start within 48 hours after the block has receded. Some may present after days or weeks.

**Symptoms** range between mild tingling and numbness to severe pain, sensory loss and motor weakness. The duration of symptoms is variable between weeks, months and even years. Look through anaesthetic charts to establish the documentation of: nerve(s) stimulated, the minimum current used, the number of attempts, use of ultrasound, the appearance of pain or paraesthesia during the procedure and measures taken, resistance to injection, type and dose of local anaesthetic agent, and patient condition during the block. (Gadsden, 2013) ( Watson and Huntoon, 2015)

#### **4.1 Examination**

#### **4.2 Ischaemic injury**

This could be due to injury to arteries or veins.

- Look for pulses, skin colour changes, oedema, tenderness, and hematomas at the site of surgery or block.
- Plasters and occlusive dressings should be removed if they are contributing to the vascular insult.
- If vascular cause is suspected, immediate referral for further tests, e.g. Doppler and/or surgical intervention is mandatory as the injury might be reversible. ( Watson and Huntoon, 2015)

#### **4.3 Neurologically mediated injury:**

- After excluding a vascular cause a thorough neurologic examination should be done. This includes detailed sensory and motor examination as well as assessment of reflexes.
- The distribution of deficit should be established: Is it dermatomal or related to a one of the nerves? Is the nerve injury likely to be caused by anaesthesia, surgery or the tourniquet? ( Watson and Huntoon, 2015)

#### **5 After History and examination:**

- Inform the anaesthetist and/or surgeon who was in charge of the patient.
- Datix should be filled.
- Patients can be managed in 2 groups:
  - Patients with mild pain or sensory symptoms.
  - Patients with persistent or severe sensory/motor symptoms or pain

#### **6 Patients with mild pain/sensory symptoms:**

- Reassure the patient that symptoms usually resolve in 4-6 weeks in over 95% of patients, and in 99% of the patients by one year.
- No further diagnostic tests are required before 6 weeks.
- Pain killers /referral to pain team might be needed.
- Patient should be followed up by telephone calls after 6 weeks.
- If no improvement after 6 weeks, patient should be considered for further investigations. (Urban and Urquart.1994. Borgeat et al, 2001)

## **7 Patients with severe pain, sensory, and/or motor symptoms**

- Patient should be referred immediately to Dr MK Varma and the concerned Anaesthetist should be informed as well.
- For a hospitalized patient, the patient should be seen ASAP and examination should take place during hospitalization.
- If the patient has already been discharged, patient should be contacted and appointment arranged for an outpatient evaluation.
- Neurology assessment will involve a more meticulous clinical examination to try to evaluate the degree of deficit and to determine what diagnostic tests are indicated.
- In patients with pain, medication for pain should be started early to prevent nerve sensitization (“see below under Drug Therapy”)
- Physiotherapy should be arranged and social services should be contacted if the injury will impact on the patient’s ability to perform activities of daily living.
- Follow up by anaesthetists should continue until the injury is completely resolved or is stable.

## **8 Diagnostic Tests**

- Should be organized by the anaesthetists.
- Diagnostic tests currently available are: Electrophysiological studies, High-resolution ultrasound, and magnetic resonance imaging.

### **8.1 Electrophysiological Testing**

- It includes nerve conduction studies (for sensory and motor deficits), and electromyography (for motor deficits).
- Nerve conduction studies evaluate the sensory and motor signal amplitude and conduction velocity in myelinated nerves.
- If the initial study is normal, there is a strong possibility that the patient has neuropraxia, which should resolve over time.
- If symptoms persist or worsen, the study may be repeated after 4-6 weeks.
- Electromyography detects spontaneous muscular fasciculation that appear in a resting muscle within 2-4weeks of the insult.
- A positive nerve conduction study detects the presence of a lesion, whereas the EMG can further localize the lesion to a specific group of muscles.

### **8.2 Doppler Ultrasound/ High frequency Ultrasound**

- Doppler ultrasound evaluates vascular causes of nerve deficits.
- High frequency ultrasound evaluates nerve rupture, inflammatory processes, and compressive syndromes in peripheral nerves.
- It is faster and more cost effective than MRI. However, it has limitations in that it is operator dependent, and is limited to superficial nerves.

### 8.3 Magnetic Resonance Imaging

- By manipulating MRI parameters, nerves can be made to show up as 3 dimensional “neurographic” images.
- MR Neurography provides high quality information about nerve compression, nerve inflammation, nerve trauma, and even systemic neuropathies.
- In some studies, MR signal changes were shown to occur as early as 24 hours after an injury.
- MR studies are limited by cost, longer scanning times, and equipment availability. (Watson and Huntoon, 2015)

### 9 Drug Therapy

- Patients with pain should be referred to the pain team to assess and start treatment.
- The most commonly used medications for the treatment of neuropathic pain are: simple analgesics, tricyclic antidepressants, anticonvulsants, and opioids.
- After starting medication therapy, consultant follow up should be arranged within 2 weeks to see if deficit has resolved, persisted, or worsened.
- If the deficit has resolved, the medication will most likely be discontinued.
- If the deficit persists, the dose of medication will be adjusted (taking into account any side effects of those medications), and 3-6 monthly follow-ups should be arranged. This should continue until symptoms resolve or become stable. (Gadsden, 2013) ( Watson and Huntoon, 2015)

### 10 References

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## Algorithm for Management of a Patient with Neurological after Peripheral Nerve Block

