EMG/NCS of the Cervical Spine Survey: Answers to the Test Questions

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On behalf of Dr. Daniel Riew, below you will find the answers to the test questions provided in the EMG/NCS of the Cervical Spine Survey. Thank you again for your participation.

1. EMGs are a reliable way to differentiate between a C5 and C6 isolated radiculopathy.

   Answer: False.

   It is often difficult to differentiate, as the tested muscles are most commonly innervated by both nerves.

2. EMGs are a reliable way to differentiate between a C8 and T1 isolated radiculopathy.

   Answer: False.

   It is often difficult to differentiate, as the tested muscles are most commonly innervated by both nerves.

3. Finding of fibrillation potential in several muscles innervated by different peripheral nerves (eg from musculocutaneous, axillary and suprascapular nerves) is how one differentiates cervical radiculopathy from a single peripheral nerve injury.

   Answer: True.

   References*: Preston et al., Gilad et al., Dumitru et al., Kimura J.

4. EMG/NCS can differentiate between brachial plexopathy (such as a Parsonage Turner Syndrome, also known as idiopathic brachial plexopathy) and C5 palsy?

   Answer: True.

   Brachial plexopathy has abnormal sensory conduction (NCS). Radiculopathies have normal sensory conduction (NCS). In patients with radiculopathy, nerve conduction studies typically are normal, and the electrodiagnosis is established with needle EMG. The reason nerve conduction studies are done is to exclude other conditions that may mimic radiculopathy, especially entrapment neuropathy and plexopathy.

   References*: Preston et al., Dumitru et al., Kimura J.

5. A patient has a C5-6 HNP and very dense numbness in the C6 dermatome without any weakness. The most likely findings on EMG and NCS are:

   A) Abnormal EMG and normal NCS
   B) Normal EMG and abnormal NCS
   C) Abnormal EMG and NCS
   D) Normal EMG and NCS

Answer: D.

A patient with numbness/ hypoesthesia, with no motor deficit and with normal sensory conduction (NCS), most likely has a radiculopathy. **Radiculopathies are preganglionic diseases, so they do not alter sensory conduction.** Therefore, NCS will be normal, unless there is a double crush with a peripheral nerve. Most patients with radiculopathy have prominent sensory symptoms, including pain and parasthesias, indicating dysfunction of the sensory nerve root. **If the sensory nerve root is preferentially affected and the motor nerve root is spared, the EMG study will be normal.** So, a patient with only sensory deficits will most likely have a normal EMG and NCS.

References*: Preston et al., Dumitru et al., Kimura J.

6. Can an EMG/ NCS identify if a patient has a prefixed or post-fixed brachial plexus?
   A) Yes, in most cases
   B) Sometimes
   C) No, never

   Answer: C.

   EMG tells us nothing about what a given patient's anatomy is like. It relies on an abnormal finding with a muscle, e.g., deltoid. We then assume that the deltoid is a C5 myotome but there is no way to know if in any given individual, the C4 root contributes (pre-fixed brachial plexus). So, an EMG/NCS gives no information about the presence of a pre-fixed or post-fixed brachial plexus.

   References*: Preston et al., Dumitru et al., Kimura J.

7. A patient awakens from surgery with deltoid and biceps weakness. Assuming that this is due to a C5 palsy, in most cases, how long will it take for EMGs to reliably confirm injury to the nerve?
   A) Within hours
   B) 1-3 days
   C) 4-7 days
   D) 1-2 weeks
   E) Several Weeks

   Answer: E.

   Between days 3 to 10, the process of Wallerian degeneration occurs: the nerve or root distal to the lesion undergoes degeneration, resulting in a low amplitude potential. The process of Wallerian degeneration is earlier for motor fibers (typically between days 3-5) compared to sensory fibers (typically between days 6-10). Once Wallerian degeneration is complete, the typical pattern of axonal loss will be seen on the exam. During the first 10 to 14 days after the onset of an acute radiculopathy, there are no needle EMG abnormalities except for decreased recruitment of MUAPs in weak muscles. Because it is unusual to find significant weakness in

radiculopathy, the EMG study often is completely normal in the acute setting. Fibrillation potentials take several weeks to develop in the more distal limb muscles; therefore, it often is best to wait several weeks before sending a patient for an EMG study, unless one is willing to repeat a normal study after several weeks to look for new changes.

References*: Preston et al., Dumitru et al., Kimura J.

8. Which of the following can be diagnosed with EMG/NCS?
   A) Myelopathy
   B) Multiple Sclerosis
   C) Amyotrophic Lateral Sclerosis
   D) All of the above
   E) B & C only
   F) A & B only
   G) A & C only

   Answer: C.

   EMGs cannot diagnose myelopathy. Needle examination can only infer injury to the central nervous system by reducing activation. Multiple Sclerosis (MS) is a pathology of the central nervous system (CNS), so EMG is normal. ALS affects motor neurons so EMGs can look identical to a radiculopathy in the early stages. However, as ALS progresses, it will begin to affect multiple myotomes and in different limbs.

   References*: Preston et al., Dumitru et al., Kimura J.

9. A patient has had C3-7 total laminectomies. How will this affect EMG/NCS?
   A) No affect
   B) EMGs will not be useful, since paraspinal analysis is the key to selecting the level
   C) EMGs may not be as sensitive, as paraspinal EMGs are usually abnormal postop

   Answer: C.

   In this case, a needle study cannot be performed in the paraspinals, as the muscles will show signs of denervation (false positive). In this case, there is no way to infer denervation due to cervical radiculopathy. EMG will be performed normally, but without the paraspinal analysis. Patients with recurrent or persistent pain after surgery often are referred to the EMG laboratory. However, the interpretation of fibrillation potentials in the paraspinal muscles of such patients is not straightforward.

   Patients who have undergone successful surgery and no longer have symptoms or signs of radiculopathy have been demonstrated to have persistent fibrillation potentials in the paraspinal muscles, often for several years. It is not clear why this occurs, but it may be related to the surgical scar through the paraspinal muscles. For this reason, the paraspinal EMG examination no longer assumes the same diagnostic importance in postsurgical patients, and it is

questionable whether sampling the paraspinals is worthwhile in such patients (i.e., the absence of denervation cannot exclude a radiculopathy, and the presence of denervation may be a "normal" finding many years after spinal surgery and is of no clinical significance).
Paraspinal muscle EMGs re an important part of the electrodiagnostic evaluation. Often, the only positive EMG finding is seen in the paraspinal muscles so if these are not done, the test will not be as sensitive.
References*: Preston et al., Wilbourn et al., Dumitru et al., Kimura J.

10. In the best electromyographer's hands, what percentage of cases where a patient has definite radiculopathy will the EMG/NCS findings be completely normal (i.e., what is the % of false negative EMG/NCSs for radiculopathy)?
    A) 5%
    B) 20%
    C) 40%
    D) 50%
    Answer: B.
    In the best of hands, it has been shown that the false negative rate is ~20%. Therefore, even with a negative test, up to 20% can have a true radiculopathy.

11. In the best electromyographer's hands, what percentage of cases where the EMG/NCS diagnoses a radiculopathy does the patient not have radiculopathy (i.e., what is the % of false positive EMG/NCSs for radiculopathy)?
    A) 5%
    B) 20%
    C) 40%
    D) 50%
    Answer: A.
    In the best of hands, it has been shown that the false positive rate is 5%. Therefore, with a positive test, 95% actually have a radiculopathy.

***References**

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3. Gilad R, Dabby R, Boaz M, Sadeh M. Cervical paraspinal electromyography: normal values in 100 control subjects. J Clin Neurophysiol. 2006;23:573–576.
4. Dumitru D., Amato A., Zwarts M. Electrodiagnostic Medicine. Philadelphia: Hanley & Belfus; 1995. Radiculopathies; pp. 523–584.
5. Kimura J. Electrodiagnosis in Diseases of Nerve and Muscle. Oxford University Press; 2001.