ELECTRODIAGNOSTIC PRINCIPLES IN PEDIATRIC PERIPHERAL NERVE LESIONS

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Electrodiagnostics is considered as an additional evaluation method that follows clinical neurological examination for the evaluation of neuromuscular diseases (1). Electrodiagnostic evaluations are composed of electroneurography (ENG) or nerve conduction studies (NCS) where motor, sensory or mixed nerves are assessed and electromyography (EMG) where muscle activity is analyzed by insertional needle electrode (2). This diagnostic method is valuable in peripheral nerves lesions detection as well as the level, severity degree and type (demyelinating and/or axonal) of such lesions. Furthermore, it is used in muscle pathology assessment and in cases with impaired neuromuscular transmission.

Electrodiagnostic evaluations are also valuable in recovery assessment of the pediatric patients with neuromuscular diseases. Sensory nerve conduction velocities (SNCV) can be performed orthodromically or antidromically, where in cases with antidromically measurements, the amplitudes are higher. Motor nerve conduction velocities (MNCV) are usually performed with stimulation on two and more sites along the nerve. Late responses are also evaluated, where proximal segments of nerve are assessed. The evaluated parameters during the NCS assessment include response latencies, amplitudes, duration, area and nerve conduction velocities (NCV) (3,4). Amplitudes can be reduced in axonal pathology and in cases with present demyelinating process (conduction block and/or dispersed response (temporal dispersion of impulses)) of the tested nerve segment. Nerve conduction velocities can be decreased in cases with axonal pathology where mild decrease can be expected if the axons with fastest conduction velocity are affected as well as in cases with demyelinating process of the tested nerve segment. The second phase of electrodiagnostic testing is EMG, where needle electrode is placed into the specific muscle.

Several stages are analyzed during the EMG including insertional and spontaneous activity when needle electrode is placed into relaxed muscle. Further stage is when muscle is minimally actively contracted where motor unit action potentials (MUAP) are analyzed including amplitude, duration and number of phases. Finally in the last stage of maximal muscle contraction, the examiner analyses firing frequency and number of MUAPs (5). It should be pointed out that the number of spontaneous pathological activity does not represent the number of axons that are damaged but rather presence of axonal degeneration, while reduction of MUAP's number and compound muscle action potential amplitude resembles axonal loss. Considering pediatric population, the EMG diagnostics should be done with a minimum steps bearing in mind test objectives in terms of diagnosis or for directing other evaluations (6). Optimal time for electrodiagnostic evaluation depends on clinical presentation, severity of lesion and child's age. After seven to ten days post nerve injury, it is possible to differentiate

whether the lesion is of neuropraxic type or as axonotmesis and neurotmesis. Further, three to four weeks after the nerve injury more information about level of the lesion, severity of the one and spontaneous pathological activity analysis can be obtained. Two to six months after the injury, electrodiagnostic testing can provide valuable information about the presence of potential nerve recovery (7).

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