Masseter H reflex

The H reflex in the masseter muscle is a monosynaptic trigemino-trigeminal reflex that is relayed via the mesencephalic nucleus of the trigeminal nerve and reflects conduction through the midbrain and mid-pons.

The H-reflex (or Hoffmann's reflex) is a reflectory reaction of muscles after electrical stimulation of sensory fibers (Ia afferents stemming from muscle spindles) in their innervating nerves (for example, those located behind the knee). The H-reflex test is performed using an electric stimulator, which gives usually a square-wave current of short duration and small amplitude (higher stimulations might involve alpha fibers, causing an F-wave, compromising the results), and an EMG set, to record the muscle response. That response is usually a clear wave, called H-wave, 28-35 ms after the stimulus, not to be confused with an F-wave. An M-wave, an early response, occurs 3-6 ms after the onset of stimulation. The H and F-waves are later responses. As the stimulus increases, the amplitude of the F-wave increases only slightly, and the H-wave decreases, and at supramaximal stimulus, the H-wave will disappear. The M-wave does the opposite of the H-wave. As the stimulus increases the M-wave increases. There is a point of minimal stimulus where the M-wave is absent and the H-wave is maximal.

H-reflexes have been used in the clinical neurophysiology laboratory for some time to assess patients with neuromuscular disorders. There are only a few reports for the application of H-reflexes for intraoperative neurophysiologic monitoring. The goals of this article are to review the intraoperative neurophysiologic monitoring of spinal nerve root function with H-reflexes. The following will be reviewed: (1) Introduction to H-reflexes, (2) pathophysiology of spinal nerve root function, (3) neurophysiologic basis of H-reflexes, (4) gastrocnemius H-reflex, (5) flexor carpi radialis H-reflex, (6) anesthetic technique and research, and (7) intraoperative applications of H-reflexes. H-reflexes are single sweep real-time recordings that provide immediate feedback to the surgeon. They can be used to monitor not only sensory and motor spinal nerve root function but also peripheral sensory and motor nerves, plexus, and postsynaptic spinal cord gray matter function [1)].

A study examined the effects of ice water caloric reflex test stimulation on H-reflex amplitude in normal subjects and three complete spinal cord injury patients. H-reflexes were obtained by stimulating the tibial nerve at the popliteal fossa and recording the H-response from the gastrocnemius muscle. All normal subjects who experienced nystagmus or vertigo demonstrated significant augmentation in H-reflex amplitude with ice water irrigation of the ear canal. In the three spinal cord-injured patients, there was no significant change of H-reflex with the ice water stimulus. The results suggest that descending tracts in the anterior spinal cord must be functional to demonstrate caloric augmentation of H-reflexes. In patients with spinal cord injury, it may be possible to predict the recovery of motor function using this test together with other clinical signs of neurological function [2)].

H-reflexes in masseter

In contrast with limb muscles, studies on H-reflexes in the trigeminal system are scarce.

A report aimed at reevaluating the responses obtained in the masseter and temporalis muscles after electrical stimulation of their nerves. Twenty-four subjects participated in the experiments. The reflexes were elicited in the masseter and temporal muscles by monopolar stimulation and recorded using surface electrodes. Stimulation of the masseteric nerve evoked an M-response in the masseter and an H-reflex in both the masseter and the temporal muscles. In contrast with the masseter muscle, where the homonymous H-reflex disappeared at higher stimulation intensities, the heteronymous temporal H-reflex remained and reached a plateau. Simultaneous stimulation of the masseteric and deep temporal nerves resulted in an M-response and an H-reflex in both the masseter and temporal muscles. Increasing stimulus intensitites led to disappearance of the H-reflex in both muscles. The results were compared with those obtained by others on limb muscles. As in these muscles, the presence of heteronymous H-reflexes in the jaw muscles can be used in future studies of motoneuronal excitability [3].

Ulkatan et al., electrically stimulated the masseteric nerve, a branch of the trigeminal nerve, and recorded ipsilateral masseteric and temporalis muscle responses. We tested eight patients who presented with trigeminal neuralgia; one patient had a temporal bone tumor and one patient had a brainstem arteriovenous malformation. All responses were elicited when patients were under general anesthesia and before the initiation of surgery.

The H reflex in the masseter muscle was reliably elicited in 70% of the patients. The reflexes met the usual criteria for the H reflex because they were elicited below the threshold of the direct M response, and their amplitudes decreased when the M response increased with stronger stimuli. The mean onset latencies of the masseter H reflex and the M response were 5.4±1.3ms and 2.6±0.6ms, respectively.

In the present study, we provide evidence of the feasibility of eliciting the H reflex in the masseter muscles of patients under general anesthesia.

The H reflex of the masseter muscle may represent a new method available for intraoperative monitoring. Specifically, this method may be important for the monitoring of brainstem functional integrity, particularly in the midbrain and mid-pons, in addition to the trigeminal nerve path [4].

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