Correlation of compound action potential and electromyography with facial muscle tension

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Abstract

Functional electric stimulation is a new method for dynamic rehabilitation of paralyzed muscles. The output of such prosthetic devices needs to be modulated by some index of the muscle movement. In facial paralysis a measure of the muscle contractions of the normal contralateral side seems to be an appropriate input. In the rabbit, we simultaneously measured the compound action potential of the buccal branch of the facial nerve, the electromyogram of the zygomaticus major muscle, and the muscle twitch tension through strain gauge. The compound action potential, electromyogram, and strain gauge each had a sigmoidal relationship to stimulus intensity. The compound action potential peak-to-peak amplitude was found to have a linear correlation to the peak twitch tension of the corresponding facial muscle. The electromyogram response, although more variable, also had a linear correlation with muscle contraction. The possibility of predicting the contraction of facial muscles before they actually occur is discussed in the context of available and future functional electric rehabilitation models.

Reference


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CASE REPORT

A 72-year-old Filipino man presented with a 5-year history of cacosmia (an unpleasant odor) and chronic left nasal drainage. Physical examination revealed nontender sinususes and a mass in the left middle meatus. Sinus computed tomography (CT) (Fig 1) revealed a calcified left maxillary sinus mass with thickening of the maxillary sinus walls and destruction of the medial wall and a direct extension into the nasal cavity. Transnasal biopsy displaced a hard mass into the nasopharynx that was expectorated. The mass, which measured 1.3 cm in diameter, was brown in color, spherical, and rock hard. Histopathological examination revealed sheets of nonseptate and branching hyphae consistent with zygomycoses species.

A left Caldwell-Luc and ethmoidectomy were performed, revealing a cystic polyloid mass with some calcified particles. The final pathology demonstrated a fungus ball consistent with Mucor species, with chronically inflamed respiratory mucosa but no bony nor submucosal invasion. Eosinophils and Charcot-Leyden crystals were absent. The patient was not treated with amphotericin and had had no evidence of recurrence at 7 months. Fungal cultures failed to grow an organism. The patient has a history of asthma but denied use of steroids for the past 10 years. The diagnosis was chronic noninvasive mucor mycetoma in an immunocompetent host.

DISCUSSION

The CT findings of rhinocerebral mucormycosis can often be nonspecific. Early paranasal sinus involvement generally appears as unilateral mucosal thickening without air-fluid levels. Evidence of bony destruction is a late finding. Increased attenuation in paranasal sinus soft tissue masses noted on unenhanced CT scans strongly suggests fungal involvement (usually Aspergillus colonizing). In addition, chronic secretions and hemorrhage can also display increased attenuation on CT scans.

Magnetic resonance imaging (MRI) may be of value in further distinguishing these entities. Hemorrhage of greater than 48-hours duration will exhibit a high signal intensity on T1- and T2-weighted MR sequences. Acute hemorrhage, chronic pastelike secretions, and mycetomas of cheesy consistency all exhibit low signal intensity on T1-weighted sequences and progressively lower signal intensity on proton-density- and T2-weighted studies. Desiccated, rocklike, chronic secretions or rocklike mycetomas produce signal void on all imaging sequences. The lower signal intensities reflect varying degrees of lack of hydration, whereas the signal void reflects the semisolid or solid physical state of the material.

The prebiopsy CT revealed a cluster of "popcorn-type" calcifications in the wall of the maxillary sinus, which extended into the sinus and also into the nasal passage. It was believed to be a chronic process, as the nasal septum was bowed rather than eroded. There was some erosion of the entire medial wall of the maxillary sinus and thickening of the sinus walls with a fluffy type pattern. Clinically, with the history of cacosmia, chronic drainage, and asthma, a calcified mycetoma or allergic fungal sinusitis were considered likely. However, on final analysis, allergic fungal sinusitis was not present because "allergic mucin" (eosinophils, Charcot-Leyden...
Fig 1. Coronal CT scan shows a solitary calcified mass in the left maxillary sinus (arrow). Reactive sclerosis of the wall of the sinus (arrowheads) is presumably related to chronic obstruction and inflammation.

crystals) was not observed on histopathological examination.

Whereas the medial maxillary wall was somewhat eroded, the remaining maxillary sinus walls were thickened, representing osteoblastic osteitis. This bony reaction is a common result of chronic fungal sinusitis. Histopathological examination confirmed the lack of bony invasion. In addition, a calcified mucor mycetoma with surrounding chronic mucosal inflammation without submucosal invasion was observed.

This case is an uncommon manifestation of mucormycosis in that it is in contrast to the classic rhinocerebral form that tends to be a necrotizing process invading orbit and brain. The patient was not obviously immunocompromised, and the fungi grew slowly despite the absence of therapy. Factors that suggested fungal involvement were the chronic course, the CT that demonstrated a calcified mass with bony erosion, the osteoblastic osteitis, and the lack of response to conventional antibiotic treatment for bacterial sinusitis. Successful treatment of noninvasive mucor sinusitis requires surgical removal of the fungal mass and establishment of adequate sinus drainage. Because the maxillary sinus is most commonly involved, the Caldwell-Luc operation is probably the procedure of choice, although the role of newer endoscopic sinus procedures remains to be determined. The excellent prognosis, despite the absence of extensive surgery or treatment with amphotericin B, stresses the importance of host factors in determining the outcome of mucormycosis.

REFERENCES