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MODULATION OF CORTICALLY EVOKED SWALLOWS BY SUPERIOR LARYNGEAL NERVE INPUTS IN ANESTHETIZED RABBITS

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Since the stimulation of cortical masticatory area (CMA) evoke both swallows and rhythmic jaw movements (RJMs), it is important to study the features and modulation of swallows evoked from CMA to understand the swallowing mechanism. This study aimed at investigating the modulation of CMA evoked swallows by stimulation of superior laryngeal nerve (SLN) in anesthetized rabbits.

Electromyographic (EMG) activities of the thyrohyoid (TH), masseter, and digastric muscles and jaw-movement trajectories were recorded to monitor RJMs or swallowing. At each CMA locus the CMA alone was stimulated for 20s followed by a 40s interval and simultaneous stimulation of the SLN and CMA was performed for 20 s. The above sequence was repeated three times at each CMA locus.

Analyses were based on 72 loci of CMA, which evoked both swallows and RJMs. The t-test was used to compare the means. The number of swallows evoked during stimulation of CMA alone (mean=1.3, SD=0.7) was significantly lower than that of simultaneous stimulation of CMA and SLN (mean=6.7, SD=1.8). The latency for evoking the first swallow during stimulation of CMA alone (mean=12.7, SD=2.8 ms) was significantly longer than that of simultaneous stimulation of CMA and SLN (mean=3.1, SD=2.3 ms). The duration of the opening phase of the swallowing cycle during stimulation of CMA alone (mean=0.12, SD=0.01 ms) was significantly shorter than that of simultaneous stimulation of CMA and SLN (mean=0.15, SD=0.02 ms). The total cycle duration of the swallowing cycle during stimulation of CMA alone (mean=0.23, SD=0.1 ms) was significantly shorter than that of simultaneous stimulation of CMA and SLN (mean=0.27, SD=0.02 ms). The area of TH activity during stimulation of CMA alone (mean=24, SD=7 A/D units) was significantly smaller than that of simultaneous stimulation of CMA and SLN (mean=28, SD=6 A/D units). The duration of TH activity during stimulation of CMA alone (mean=129, SD=20 ms, n=15) was significantly shorter than that of simultaneous stimulation of CMA and SLN (mean=147, SD=26 ms).

The present findings revealed that SLN inputs caused increased swallowing frequency, the area and duration of TH activity and the reduced latency for evoking the 1st swallow of CMA evoked swallows. Elongated opening phase of swallowing cycle due to SLN inputs indicates that swallows occur in the opening phase of the chewing cycle. These findings explain the natural swallowing mechanisms as the volume and consistency of food bolus may affect the swallow related muscle activity and occurrence of swallows in a chewing cycle. In conclusion, the present findings revealed that both cortical descending inputs and peripheral inputs are important in the regulation of swallowing.