Brainstem fMRI

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The human brainstem plays important roles in maintaining basic vital functions. In comparison with brain functional magnetic resonance imaging (fMRI), only a few fMRI studies investigating the brainstem have been reported because of a number of technical challenges. This entry briefly introduces technical difficulties, recent advances, and further directions of brainstem fMRI in humans.

brainstem fMRI human

The human brainstem plays important roles in maintaining basic vital functions, e.g., respiration, swallowing, and walking. The brainstem nuclei play essential roles in the regulation of behavior and cognition via cortical/subcortical projections and nerves originating from the nuclei [1]. For instance, the brainstem nuclei for vagal motor innervation are the nucleus ambiguus and dorsal motor nucleus of the vagus, and the final motoneurons are the ganglia in the lower respiratory tract and lung, the cardiac ganglion, and enteric neurons in the abdominal organs. The vagus nerve supplies the pharynx, larynx, and esophagus (general motor and sensory); the thorax and abdomen (visceral); and the thoracic and abdominal organs (parasympathetic nerve endings). Parasympathetic neurons in the dorsal vagus motor nucleus innervate the ganglia in the gastrointestinal wall and other abdominal organs. The motor nucleus modulates visceral motor function, e.g., activities of the gastrointestinal smooth muscle. The brainstem nucleus for the vagal sensory innervation is the nucleus tractus solitarius. As for the swallowing function, most of the motor or sensory nerves supplying to the pharynx originate from the pharyngeal plexus. The plexus consists of the branches of the glossopharyngeal nerve, vagus nerves, and superior cervical sympathetic ganglia. The pharyngeal muscles are innervated from the pharyngeal plexus (through the vagal pharyngeal branch), except the stylopharyngeus (innervated by the glossopharyngeal nerve) [2][3].

However, unlike a large amount of brain functional magnetic resonance imaging (fMRI) research, only a much less number of fMRI studies investigating the brainstem have been reported until now due to various technical challenges. This entry briefly introduces technical difficulties, recent advances, and further directions of brainstem fMRI in humans.

References

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