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Limb apraxia and aphasia

Apraxia de membros e afasia

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The earliest known description of a case of apraxia is attributed to Hughlings Jackson (1861)[1], although he did not give a specific name to the disorder. The term "apraxia", from the Greek *apraksía* (απραξια - "inaction") was first used in the modern era by Steinthal[2] to describe deficits in planning and execution of motor actions due to neurological injury. However, it was the German neurologist Hugo Karl Liepmann who established the conceptual foundations of apraxia in its various forms of presentation at the beginning of the twentieth century[3], and these foundations have continued to influence research and theoretical speculations on the subject to this day. With some minor variations among authors and schools, there is a theoretical consensus that apraxia of the limbs corresponds to an "acquired deficit in the execution of purposive (voluntary/intentional or skilled) movements, as a consequence of neurological dysfunction, which cannot be fully or satisfactorily explained by elementary motor or sensory impairment, comprehension problems, coordination deficits in object recognition, intellectual impairment or uncooperativeness[4,5]. This places apraxia in the very peculiar position of being neither a cognitive nor a motor disorder, but rather, something that stands at the cognitive-motor interface. Although limb apraxia may follow neurological dysfunction of any etiology, it is most commonly caused by stroke or Alzheimer's disease, and it constitutes a hallmark of corticobasal degeneration[6].

Over the years, apart from conceptual difficulties, it became clear from clinical observations that limb apraxia predominantly follows left-hemisphere lesions, and is frequently associated with aphasia. Furthermore, limb apraxia often affects not only internally generated gestures (i.e. those primarily conceived by the individual to achieve a specific purpose), but also imitation (pantomime), communicative gestures and use of objects and tools in different combinations. These observations have given rise to attempts to bring the theoretical conceptions regarding praxis and its disorders closer to those from the better-understood language system. Hence, in addition to the classical forms of "ideational apraxia", "ideomotor apraxia", "melokinetic apraxia" and "callosal apraxia", new classifications such as "conduction apraxia", "verbal dissociation apraxia" and "conceptual apraxia" have been introduced and it has been learned that apraxia may selectively impair meaningless gestures rather than meaningful gestures, and that the latter can be classified as transitive or intransitive, which renders the analogy to the language system complete[6,7].

In this sense, current cognitive models for normal praxis propose that, similarly to what happens in language processing, a visual or auditory stimulus triggers an action input lexicon, which activates an action semantic system and leads to selection of an appropriate gesture from the action output lexicon. The selected gesture is then "put into motion" through the motor system. In such cognitive models, the auditory stimulus may be represented by a command (e.g. "Show me how you would comb your hair" or "Show me how you would wave goodbye"), and visual stimuli may comprise seeing an actual tool or object that has to be properly manipulated (e.g. "How would you use this?", while showing a pair of scissors), or a gesture that has to be imitated (e.g. "Do the same thing I'm doing", while demonstrating a meaningful or meaningless action). Limb apraxia may arise from deficits in the semantic system (when conceptual deficits are observed) or be "procedural" in nature, such that the semantic system appears to be intact, but the production of gestures is impaired[8].

In the paper "Limb apraxia in aphasic patients", Ortiz and Mantovani-Nagaoka[9] explore the most up-to-date concepts regarding praxis cognitive models, focusing on post-stroke aphasic patients. In clinical practice, there are some difficulties regarding the evaluation of limb apraxia, given that it can be masked by hemiparesis, and comprehension deficits may hamper the patient's ability to perform more complex, multi-step actions. Use of a comprehensive battery to assess lexical-semantic aspects of gesture comprehension and production separately goes a step further than the standard symptom-oriented examination, and allows deeper insight into the nature of the deficits. More importantly, a thorough limb apraxia assessment in situations of aphasia helps to reveal the similarities between praxic and linguistic abilities.

Language and praxis are the most lateralized functions in the human brain and a closer look at their neural substrates shows a striking overlap involving the left frontal and parietal lobes (although the two systems may be anatomically adjacent, yet functionally separate). The prevalences of aphasia and apraxia after a single left-hemisphere stroke are very similar, approaching 40% each, and their co-occurrence is very frequent[10,11]. Human communication, in spite of the acquisition of a highly sophisticated verbal system, still relies greatly on gesturing in order to maximize its efficiency. Scholars in the field of language evolution cannot foresee a day when the endless debate about whether human language evolved from primitive hand gesture-based communication[12] will cease. Taken together, all these facts highlight the close relationship between language and action and they show the relevance of careful examination for limb apraxia in aphasic patients. Full appraisal of the co-existence and severity of these two syndromes may have a direct impact on efforts towards patients' rehabilitation and, in the long run, may open a window to better understanding of how our species came to develop such a remarkable ability as language.

References

1. Jackson JH, 1861. Cited by Wilson SAK. A contribution to the study of apraxia with a review of the literature. Brain. 1908;31:164-216.
2. Steinthal H. Abriss der Sprachwissenschaft 2nd ed. Berlin: F Dummlers, 1881 (Vol I: Einleitung in die Psychologieund Sprachwissenschaft),
3. Liepmann H. Das Krankheitsbild der Apraxie ('motorischen Asymbolie') auf Grundeines Falles von einseitiger Apraxie. Monatsschriftfür Psychiatrieund Neurologie. 1900;8:15-44.
4. De Renzi E, Faglioni P. Apraxia In: Denes G, Pizzamiglio L, editors. Handbook of clinical and experimental neuropsychology. Hove: Psychology Press; 1999. p. 421-40
5. Heilman KM, Watson RT, Rothi LJG. Disorders of skilled movements: limb apraxia. In: Feinberg TE, Farah MJ, editors. Behavioral neurology and neuropsychology. 2nd ed. New York: McGraw-Hill; 2003. p. 217-24.
6. Greene JDW. Apraxia, agnosias, and higher visual function abnormalities. J. Neurol. Neurosurg. Psychiatry. 2005;76 Suppl 5:25-34. https://doi.org/10.1136/jnnp.2005.081885
7. Bartolo A, Ham HS. A cognitive overview of limb apraxia. Curr Neurol Neurosci Rep. 2016;16(8):75. https://doi.org/10.1007/s11910-016-0675-0
8. Cubelli R, Marchetti C, Boscolo G, Della Sala S. Cognition in action: testing a modelo flimb apraxia. Brain Cogn. 2000;44(2):144-65. https://doi.org/10.1006/brcg.2000.1226
9. Ortiz KZ, Mantovani-Nagaoka J. Limb ataxia in aphasic patients. Arq Neuropsiquiatr. 2017;75(11):767-72. https://doi.org/10.1590/0004-282X20170150
10. Kobayashi S, Ugawa Y. Relationships between aphasia and apraxia. J Neurol Transl Neurosci. 2013;2(1):1028.
11. Goldenberg G, Randerath J. Shared neural substrates of apraxia and aphasia. Neuropsychologia. 2015;75:40-9. https://doi.org/10.1016/j.neuropsychologia.2015.05.017
12. Ardila A. A proposed neurological interpretation of language evolution. Behav Neurol. 2015;2015:872487. https://doi.org/10.1155/2015/872487