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Review Article

Apraxia: Definition, clinical contexts, neurobiological profiles and clinical treatments

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Abstract

Starting from the general concept of Apraxia, the present work focuses on the clinical, neurobiological, and functional aspects of the morbid condition, suggesting a multidimensional treatment between rehabilitation exercises for lost skills and psychotherapy.

Contents of the manuscript

Apraxia (from the Greek *a-praxía*, inability to do) is a neuropsychological disturbance of the voluntary movement, defined as the inability to perform coordinated gestures directed towards a certain goal, although the will of the subject and his ability are maintained unaltered physical education; as in many other neurological diseases, people with this disorder generally don't know they are. To exclude that it is hyposthenia, however, as a differential diagnosis, we observe the various muscles engaged as a whole, for the chosen action, as well as a family history to better define the exact diagnosis (as certain forms can be also family members). Computed tomography and magnetic resonance imaging can ultimately prove useful in that they precisely define the nature of the injury-causing the disorder [1-4].

Following the brain injury, the deficits are not always obvious or it happens that certain spontaneous recoveries are not completely complete, manifesting themselves in apraxic phenomena of various levels (mild, moderate, serious, very serious). For a correct evaluation it is therefore important to exclude in the differential diagnosis all cognitive and not cognitive deficits that could compromise the patient's psychic and/or sensory abilities, as happens in dementia, personality disorders, blindness, and deafness, carefully evaluating all types of gestures [5,6].

a) *transitive gestures*: it is the concrete manipulation of objects in an activity that can be simple (use a comb,

a toothbrush, a match or a pin) or complex/articulated (light a candle with a matchbox or pack a package);

b) *intransitive gestures*: these are gestures that do not involve the use of objects (on order and imitation) but are equally physical, symbolic (a sign of the cross, military salute or say goodbye, mimicry (ironing, planting a nail, washing teeth) or arbitrary imitative (fingers crossed to form an 8);

c) *arbitrary sequences* (beat the hand punch, palm, cut, punch, palm, cut);

d) *contrasting gestures* (strong hit - weak hit);

e) *graphic and construction activities* (spontaneous or dictated writing and drawing, reproduction of geometric figures with the use of toothpicks or using special games and reproduction of graphic sequences such as line, point, curve, line, point, curve);

f) *common daily activities concerning clothing* (wearing a jacket and trousers or making a tie).

According to the level of elaboration of the motor act, the following apraxic forms are therefore distinguished [4,7-9]:

ideational apraxia, in which the dysfunction is in the process of mental representation of the gesture or sequence of movements to be performed. It appears to be caused by a lesion of the temporal-parietal-occipital crossroads of the



left hemisphere. In the use tests of objects, frequent errors of omission, erroneous use, incorrect localization, clumsiness, perplexity and sequence errors are observed;

ideomotor apraxia, in which dysfunction occurs in the process of translating the gesture with meaning into the motor program for the individual muscle groups. The lesion usually concerns the left cerebral hemisphere, in particular, a lesion of the parietal lobe causes more frequently the severe form, compared to a frontal lesion of the lateral premotor area. An injury to the corpus callosum can cause this apraxic form in the ipsilateral limbs to the dominant hemisphere. The difficulties in the imitation tests highlight the ideomotor form since the idea of the gesture is provided by the experimenter, therefore there is no ideational one;

acrokinetic apraxia involves lesions in the premotor areas, with preserved ideation but lack of fluidity, slowness and awkwardness, difficulty of passing synchronously, and organized from the contraction of a muscle to the subsequent relaxation. In this type of apraxia, both spontaneous and voluntary movements are affected, some difficulties increase according to the complexity of the task, but do not vary based on the type of object or imitation.

constructive apraxia is characterized by the inability, following a brain injury, to correctly produce three-dimensional constructions or two-dimensional drawings, both from memory and imitation. It can result in both left and right brain injuries. Usually, when the lesion affects the left side of the brain, the subject tends to simplify the drawing and make it smaller; when there are right lesions, severe spatial disorganization and loss of detail on the left side are observed in the drawing. Constructive apraxia may depend on deficits in the visual-spatial analysis systems (right parietal lobe), action planning and monitoring (frontal lobes), tactile and proprioceptive sensitivity, semantic memory;

motor apraxia involves in the disorganization of movement similar to elementary motor disorders, characterized by a reduction in motor spontaneity and by forms of prehension (frontal lesion) and avoidance (parietal lesion) observed in the contralateral embody to the lesion;

dynamic apraxia is characterized by the presence of persevering inability to subject the action to a motor project, for a lesion of the frontal lobe. Limb apraxia is the most studied form as it has a greater impact on quality of life, while oral (or Bucco-facial) apraxia is generally associated with a lesion of the front and central operculum and the anterior portion of the insula.

Brain injury studies currently use techniques such as computed tomography, functional magnetic resonance imaging, single photon emission tomography and positron emission tomography. The renowned neuropsychologist Alexander Romanovich Luria [10], has been conducting cognition studies without the use of imaging technologies for many years, in a large number of patients with brain lesions, and has explored the complex behavior and specific brain functions involving lobes and sub-areas. For example, he has conducted several

specific studies on memory and mental organisation, including cases of apraxia, and has found that this lobe is also involved in lesions [11].

The prognosis [12], will depend on the type, size and position of the lesions, the degree of compromise, the age of the patient and the targeted efficacy of pharmacological [13] and rehabilitative therapy and speech therapy and psychotherapy [14], for any comorbidity with the psychological and psychiatric symptoms [15,16], such as anxiety disorders [17], post-traumatic stress disorder [18], depression [19], obsessions [20], suicidal risk [21], personality disorders and as a consequence of degenerative neurological diseases [22-25].

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