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A single case-study of diagonistic dyspraxia

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Abstract

Diagonistic dyspraxia is a clinical syndrome usually characterized by involuntary and conflicting behaviors between the hands following corpus callosum lesions. In the present study, we report the case of a patient who presents such symptoms, along with a series of complex abnormal behaviors, such as carrying out an action and subsequently doing the exact opposite, or being unable to choose between two alternative decisions. The data reported in this study indicate that, at least in some patients, diagonistic dyspraxia can be associated with abnormal, antagonistic, behaviors not limited to the hands. In our view, diagonistic dyspraxia result from lesion of the posterior corpus callosum while associated complex abnormal behaviors result from concomitant anterior lesions.

1. Introduction

Diagonistic dyspraxia (DD) is usually defined as a transient conflict between the two hands following corpus callosum (CC) lesions. Akelaitis (1945) reported the first detailed report of diagonistic dyspraxia in two patients who had undergone callosotomy. One of the patients would for example dress with the right hand, while simultaneously undressing with the left. Tanaka, Yoshida, Kawahata, Hashimoto, and Obayashi (1996) recently provided an in-depth report of eight patients with CC lesions, three of which presented with DD. The abnormal behaviors reported in these three patients included: (a) antagonistic movements between the left and right hands; (b) involuntary movements to the right; (c) symmetric movements to the right during which the left hand sometimes preceded the right; and (d) occasional inability to move either hand during a bimanual task. All of these abnormal behaviors were limited to the hands. Based on the anatomical data, the authors concluded that these singular behaviors resulted from a lesion to the ventral part of the posterior third of the corpus callosum. Indeed, commissural fibers passing through this area allow a connection between both superior parietal lobules, which are thought to be involved in the selection of movements. According to the authors, a disconnection between these brain regions could account for these conflicting hand movements.

Nonetheless, Nishikawa et al. (2001) recently reported two patients (Patients 1 and 3) who presented symptoms which contrasted with previous reports. In these patients, abnormal behaviors involved the hands, but also the whole body and thoughts. For example, Patient 1 reported: ''I wanted to take a bath and go to the toilet at the same time, and could not choose one of them.'' These two patients had lesions of the posterior and anterior parts of the CC. Similar complex abnormal behaviors were reported in callosotomized patients (Fergusson, Rayport, & Corrie, 1985). Patient JAC would go in the bathroom to take a shower, take off his pants, and then put them back on without having taken his shower. Patient POV's shopping could last up to 3 h as she ''could not decide which fruit pastry to choose'' for her child.

It is thus unclear whether abnormal behaviors following CC lesions are always limited to the hands, as is usually assumed. In the present study, we report the case of a patient who presents with abnormal behaviors

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following CC lesions. Some of the behaviors reported here involve only the hands, while others involve more complex actions.

2. Case report

Patient JJL is a 41-year-old right-handed man. He was admitted to emergency because of a violent headache and a confusional state. A bleeding aneurysm of the left pericallosal artery was diagnosed. Subsequent surgery required aspiration of the callosal haematoma through the left anterior cingulate gyrus. A brain MRI was performed five months later. The MRI sections show lesions of the rostrum, genu and body of the CC, while the posterior third of the splenium appears to be preserved. A circumscribed lesion of the left anterior cingulate gyrus and of the left prefrontal cortex can also be observed. The right hemisphere is intact.

A callosal disconnection syndrome was observed and included: Unilateral tactile anomia, unilateral left agraphia, unilateral left ideomotor apraxia, unilateral right constructive apraxia, auditory left suppression, unilateral right verbal anosmia, difficulties in somesthesic transfer of distal hand positions, and inability to coordinate alternated movements between the left and right hand. Somatic neurological examination was normal. Neither grasping nor groping was observed. JJL is independent in everyday life. However, he has not started working again, as he feels the right and left sides of his body are not well coordinated. JJL underwent a neuropsychological assessment 14 months after his accident. General intellectual efficiency was below normal ($IQ = 75$), as indicated by his performance on the WAIS-R, and by his scores on Raven's progressive matrices (25th percentile).

JJL was anxious during the first month following his accident, as he suffered from strange behaviors that occurred against his will. In the present study, we report such "episodes" or verbal descriptions of transient abnormal behavior. These episodes involved either only the hands or much more elaborated behaviors (Table 1). His wife confirmed all of the episodes described here in a separate interview.

3. Discussion

We reported several episodes of diagonistic behavior in a patient with CC lesions. Some of these episodes involved only the hands. Others involved the whole body and complex actions. For example, JJL correctly carried out some actions, but would immediately do the exact opposite (episodes 6–8). He also had difficulties choosing between objects he wanted to buy (episode 9). JJL thus present abnormal behaviors similar to those reported by other patients following CC lesions (Fergusson et al., 1985; Nishikawa et al., 2001).

Yet, how can we explain the fact that some patients show DD limited to the hands (Tanaka et al., 1996) while others present more complex behaviors (JJL, Fergusson et al., 1985; Nishikawa et al., 2001)? The three patients presented by Tanaka et al. (1996) had lesions solely limited to the posterior third of the CC. In contrast, JJL and the patients described by Fergusson et al. (1985) and Nishikawa et al. (2001) had lesions of the posterior *and* anterior portions of the CC. Based on these data, we suggest that extensive lesions of the CC could account for the existence of forms of DD combining both abnormal movements of the hands (due to posterior lesions) and higher order abnormal behaviors (resulting from the combination of posterior and

Table 1
Episodes reported by patient JJL

Episodes of diagonistic dyspraxia	
1.	JJL puts his jacket on, but his left hand starts pulling it off. A struggle ensues between the two hands, where the right hand puts the jacket back on while the right hand simultaneously pulls the sleeve in the opposite direction.
2.	JJL opens the door with his left hand, but closes it again with his right hand. This behavior lasted until his wife came to help him.
3.	JJL is eating, and while he is holding his knife with the right hand, the left hand comes across, grabs the right hand's wrist, and prevents it from cutting the food.
4.	JJL goes into a store to buy some cigarettes. He puts the money on the counter with the right hand, but the left hand takes it back. This happens several times until the cashier asks him what is going on.
5.	JJL sits at a desk and is asked to assemble cubes. He has already successfully built a pyramid with his left hand several times. When asked to build that pyramid again with the same hand, he remains motionless. JJL explains that his hand doesn't want to move anymore.
Episodes of complex abnormal behaviors	
6.	JJL puts his shoes on, ties his laces, then unties them, takes the laces off the shoes and throws them under the bed.
7.	JJL gets dressed completely, but then undresses entirely again. He then gets dressed once more, and undresses again. The nursing assistant comes in the room and asks him to dress. He gets dressed again, but keeps on undressing after having dressed.
8.	JJL is laying the table for dinner. After he has done so, he then takes all the plates, glasses, knives and forks away and puts them back into the drawers.
9.	JJL is in a shop to buy a pair of pants, he holds one in each hand but reports to be then in the incapacity to choose one of them.

anterior lesions). JJL and Patient 3 described by Nishikawa et al. (2001) also had lesions of the frontal cortex. On the other hand, Patient 1 of Nishikawa et al. (2001) had lesions limited to the CC, and the two patients reported by Fergusson et al. (1985) underwent callosotomy and most likely did not sustain cortical damage. Concomitant cortical lesions of the frontal lobes do thus not seem to be necessary for these symptoms to appear, although they could enhance them.

The anterior part of the CC connects the frontal lobes which are assumed to be crucial in executive functioning processes. This could justify why some patients with anterior CC lesions have difficulties with higher-order cognitive processes such as the inhibition of antagonistic actions or the selection between two alternative decisions. The question might be raised as to whether or not these abnormal behaviors result from a general nonspecific dysexecutive syndrome, such as a deficit in intellectual efficiency. Although JJL's IQ and that of Nishikawa's patients (2001) is low, this idea seems unlikely to us, since most patients with low IQs do not present these types of behaviors. It is also noteworthy to mention that these abnormal behaviors are transient, in that they are well carried out most of the time, but are occasionally ill-performed. This does not argue in favor of a permanent impairment, as is usually the case in a dysexecutive syndrom. Finally, all of these abnormal behaviors, some of them strikingly similar across patients, are consecutive to CC lesions. This suggests that CC lesions can sometimes result in some patients in this atypical syndrome. Several points remains yet unclear: Why do some but not all patients with extensive CC lesions show such complex abnormal behavior; why have such behaviors never been reported following anterior only CC lesions?

In summary, the data presented in this study indicate that DD can be associated with complex abnormal behaviors that are not solely limited to the hands. Such complex behaviors are likely to be associated with extensive lesions of the posterior and anterior parts of the CC.

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