

Alien Hand Syndrome

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In Stanley Kubrick's movie *Dr Strangelove*,¹ the main character is described as "erratic" and displays a bizarre movement disorder. His right hand seems to be driven by a will of its own, at times clutching his own throat and at other times raising into a Nazi salute. Dr Strangelove must try to restrain this wayward limb with his left hand. Bizarre as this fictional character is, a similar movement disorder can occur in neurologic disease. The complex phenomenon associated with this disorder falls under the rubric of alien hand syndrome. This syndrome is characterized by a limb that seems to perform meaningful acts without being guided by the intention of the patient. Patients find themselves unable to stop the alien limb from reaching and grabbing objects, and they may be unable to release these grasped objects without using their other hand to pry open their fingers. These patients frequently express astonishment and frustration at the errant limb. They experience it as being controlled by an external agent and often refer to it in the third person. This article outlines the origins of the terminology used in describing this syndrome, early observations, and studies regarding its functional neuroanatomy.

TERMINOLOGY

The phenomenon of alien hand syndrome is complex and can vary across patients. Accordingly, it has been described with different terms comprising different clinical signs. These terms fall into 3 broad categories (**Table**):

1. Terms that describe an apparent conflict of will with behavior of the hands in which they seem in opposition to each other (*intermanual conflict*, *diagonistic apraxia*, or *agonistic apraxia*).
2. Terms that describe the alien limb's aberrant movements, which are often perseverative and stimulus bound (*compulsive manipulation of tools*, *anarchic hand*, or *magnetic apraxia*).
3. Terms that describe the subjective reaction to this limb (*autocriticism*, *interhemispheric autocriticism*, or *strange hand sign*).

The term most commonly used is *the alien hand*. The original term, *la main étrange*,

was coined by Brion and Jedynak⁸ in 1972. They described patients who had undergone corpuscallosotomy and then failed to recognize their own left hand when deprived of visual input, as when the hands were put behind the back or with the eyes closed:

M.A. . . . was putting on his shirt with difficulty, and looking for the sleeves behind his back, when, incidentally, he took hold of one hand with the other; he pulled on it, tried to get away, and said: "Let go of my hand, you're keeping me from getting dressed." This lack of awareness of ownership of one of his hands was afterwards found every time we looked for it, by putting his hands behind his back or in front, with his eyes closed. This strange disorder, which gives the impression of having a strange hand, is found in other patients . . . [observation 1]. Ms B., when tested for the strange hand sign, was asked, "What do you have in your right hand?" "A hand," she replied. "To whom does the hand belong?" "Not to me, in any case" [observation 2].^{8(pp259-260)}

In their original article, Brion and Jedynak translated *la main étrangère* to English as "the strange hand sign." However, Wilson et al⁷ modified this term to *the stranger's hand sign*. This shift of de-

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scribing the hand to ascribing a distinct and independent will to it made way for the suggestion by Bogen² to name the phenomenon the alien hand. Bogen wished to include the idea that the patient lacked control of these hand movements:

This is a circumstance in which one of the patient's hands, usually the left hand in the right-handed patient, behaves in a way which the patient finds "foreign," "alien," or at least uncooperative. Even our youngest patient (LB), who had no long-term appreciable apraxia to verbal command, manifested this alienation three weeks after surgery: while doing the block design test unimanually with his right hand, his left hand came up from beneath the table and was reaching for the blocks when he slapped it with his right hand and said, "That will keep it quiet for a while."^{2(p361)}

HISTORICAL CASES

Although the clinical entity of the alien hand syndrome was reified in the 1970s, earlier clinical descriptions are found in writings on apraxia and abnormalities of motor control. Liepmann,^{12,13} in his seminal article on apraxia from the early 20th century, described a civil servant who among other impairments had an alien hand. His behavior included intermanual conflict (hands act at cross-purposes) and many involuntary movements:

[T]he patient's left arm imitates everything correctly, the right arm performs completely different movements or none at all, again with frequent spreading of the fingers when movements of the entire arm are requested.^{13(p164)} . . . He is asked to pour water from a jug into a glass. His left hand takes the jug and wants to pour, but, simultaneously, his right hand lifts the empty glass to his mouth.^{13(p172)} . . . When he attempts to use his right hand, this hand often grabs hold of the left hand instead and pulls it to the midline; then he claps his hands.^{13(p180)}

Goldstein,¹⁴ also writing about apraxia, described a patient who developed left alien hand behavior following a right anterior cerebral artery infarction:

On one occasion the hand grabbed her own neck and tried to throttle her, and could only be pulled off by force. Similarly, it tore off the bedcovers against the patient's will. . . . She soon is com-

Terms and Clinical Signs in Alien Hand Syndrome	
Term	Definition
Alien hand	Foreign or uncooperative behavior of a hand. This term is used today as the name for the syndrome with all of its components. ²
Posterior alien hand	The alien hand syndrome that may follow posterior lesions, characterized by hand levitation and abnormal postures. ³
Aberrant motor behavior of the alien hand Magnetic apraxia/repellent apraxia	Instinctive grasping/avoiding with an abnormal posture. ⁴
Compulsive manipulation of tools	Manipulating objects by the abnormal hand against the patient's own will. This term is used mainly in the Japanese literature. ⁵
Anarchic hand	Autonomous behavior of a limb without the denial of ownership. ⁶
Subjective reaction Stranger's hand sign Strange hand sign	Denial of ownership of a limb. ⁷ The original meaning of the alien hand sign (<i>la main étrangère</i>). Failure to recognize the abnormal hand as one's own hand. ⁸
Autocriticism, interhemispheric autocriticism	Expression of astonishment with the behavior of the abnormal hand. ⁹
Interhand interaction Diagonistic dyspraxia	A conflict between the desired act and the performed act. ¹⁰
Intermanual conflict Agonistic dyspraxia	The hands act at cross-purposes to each other. ² Compulsive automatic execution of orders by one of the hands when the patient is asked to perform the movement with the other hand. ¹¹

plaining about her hand; that it is a law unto itself, an organ without will; when once it has got hold of something, it refuses to let go: "I myself can do nothing with it; if I'm having a drink and it gets hold of the glass, it won't let go and spills [the drink] out. Then I hit it and say: 'Behave yourself, hand.' (smiling) I suppose there must be an evil spirit in it."^{14(pp169-170),15(p164)}

ANATOMY

Alien hand syndrome most commonly follows lesions in the medial frontal lobes and corpus callosum. It is also encountered with more posterior strokes (posterior alien hand syndrome) and in patients with corticobasal ganglionic degeneration.¹⁶ The role of callosal damage in this syndrome was not immediately obvious. In the early 1940s, Akelaitis¹⁰ studied a large series of patients following corpuscallosotomy and recorded the alien hand phenomenon. In describing patients whose hands acted at cross-purposes, he introduced the term *diagonistic dyspraxia*:

In tasks requiring bimanual activity the left hand would frequently perform

oppositely to what she desired to do with the right hand. For example, she would be putting on her clothes with her right hand and pulling them off with her left hand, opening a door or drawer with her right hand and simultaneously pushing it shut with the left hand.^{10(p595)}

He also noted the inability of these patients to recognize the nondominant limb as their own hand¹⁷ (similar to the original meaning of *la main étrangère*). However, rather than attribute these phenomena to callosal damage, Akelaitis thought that they were produced by psychological factors or epileptic variants.

A subsequent study by Gazzaniga et al¹⁸ on patients who had undergone corpuscallosotomy recognized the importance of the corpus callosum in these peculiar movements:

She has also noted antagonism between the actions of the right and left hands, eg, the patient would pick up the evening paper with the right hand, but put it down abruptly with the left and then have to pick it up again with the right. Similar contradictory movements were observed occasionally in the

course of dressing and undressing, and in other daily activities, at times on a scale sufficient to be distinctly bothersome. It was as if the control of the left hand were strongly centered in the minor hemisphere at such times and hence isolated from the main intent and prevailing directorship of the dominant hemisphere.^{18(p1767)}

Patients with corticobasal degeneration sometimes have signs that resemble alien hand syndrome. Rebeiz et al¹⁹ described 3 patients with abnormal control of movements, abnormal posture, and involuntary motor activity:

[I]t was observed that when she used her right hand for objects on her left side, her left hand would join in . . . [case 1]. However, when he moved his right arm, the left arm tended to rise or swing over to the right side . . . [case 2].^{19(pp23,27)}

The movement abnormalities in corticobasal degeneration differ from those seen in patients with lesions in the frontal lobes or corpus callosum. In corticobasal degeneration, perseverative movements are less common, especially early in the disease. The alien limb is more likely to drift or levitate and assume odd postures. Similar patterns of movement can occur with parietal lesions. Denny-Brown⁴ described magnetic and repellent apraxias in his discussion of frontal and parietal lobe interactions. He believed that these regions were linked in terms of approach and avoidance behaviors, with the parietal lobe mediating approach behaviors and the frontal lobes mediating avoidance behaviors. Frontal lobe damage then released parietal approach behaviors, such as the grasp reflex or magnetic apraxia. Parietal lobe damage released frontal avoidance behaviors, which resulted in abnormal everted and overextended postures called repellent apraxia. Writing about magnetic apraxia, Denny-Brown commented,

In the patient with frontal lobe lesion the prominence and persistence of instinctive grasping constitute a major disturbance of motor coordination. The patient may not be able to relax his grasp on the bedclothes or other object. The grasp continues because the overactive effect of the stimulus to the palm persists. The hand actively pursues the stimulus.^{4(p17)}

He contrasted this behavior with repellent apraxia:

Rarely the phenomenon is so remarkable that the fingers and wrist and even the whole arm, may extend as the examiner approaches ("levitation"). If the patient can use the hand to grasp an object, it is seen that the fingers and wrist extend to an abnormal degree as the object is approached, giving an impression of exaggerated and unnecessary movement.^{4(p19)}

The striking phenomenon of alien hand syndrome has captivated the imaginations of philosophers and neuroscientists interested in the biological basis of consciousness and will. However, most of the literature on alien hand syndrome has been descriptive. With increasing understanding of motor control and notions of will and self, experimental studies can be designed to test further anatomical and physiological hypotheses regarding this fascinating syndrome.

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