SYNDROME OF FINGER AGNOSIA, DISORIENTATION FOR RIGHT AND LEFT, AGRAPHIA AND ACALCULIA
LOCAL DIAGNOSTIC VALUE
JOSEF GERSTMANN, M.D.*
NEW YORK

This paper is concerned with the syndrome, described by me some years ago, of finger agnosia, disorientation for right and left, agraphia and acalculia, appearing as a result of a cerebral lesion located in the transitional area of the lower parietal and the middle occipital convolution.

In 1924 I first described the symptom of primary elective disability for recognizing, naming, selecting, differentiating and indicating the individual fingers of either hand, the patient's own as well as those of other persons, and called the condition "finger agnosia." Subsequent to this gnostic disorientation with respect to the fingers, restriction in their separate kinetic realization not infrequently occurs. I also showed that the symptom of finger agnosia is characteristically associated with disorientation for right and left in respect to the patient's own body, as well as that of other persons, with special reference to the hands and fingers. The symptoms tend to appear in varying degrees of development. Furthermore, I found that these symptoms are commonly combined with an isolated disturbance of writing—agraphia—and an isolated disability for calculation—acalculia—of differing intensities and of definite character. All these symptoms group themselves pathologically into a well circumscribed cerebral syndrome. Investigations in a large number of cases of this type have so far failed to reveal any evidence of psychic, particularly of intellectual, disorder; of aphasia, apraxia or other manifestation of agnosia, or of motor or sensory changes to which the symptom complex of finger agnosia or its individual features could be related. This syndrome has therefore been

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*Formerly Professor of Neurology and Psychiatry, the University of Vienna; at present at the Neurological Institute of New York, Neurological Division of Vanderbilt Clinic.
considered primary. It was eventually proved, in the sense of the assumption expressed in my first paper, that the syndrome of finger agnosia, confusion of right and left, agraphia and acalculia is a result of a lesion located in the parieto-occipital region of the brain, namely, in that part which corresponds to the angular gyrus in its transition to the second occipital convolution.

A considerable literature followed the description of the syndrome. A number of authors in different countries (Herrmann and Pötzl, Schilder, Kroll, Lange, Marburg, von Rad, Schuster, Pineas, Klein, van Woerkom, Emde. Ehrenwald, Laubenthal, Conrad, Engerth, von Stockert, Pedersen, Muncie, von Angyal, Wagner, Mayer-Gross, Mussio-Fournier and Rawak, Nielsen, Strauss and Werner) have made careful studies. It may be said that in all the publications up to the present my data on finger agnosia and its association with disorientation for right and left and isolated disorder in writing and calculating as a special cerebral symptom complex have been confirmed so extensively and uniformly that the syndrome may now be considered as established.

The syndrome has proved not to be rare, when looked for. Since my first observation, I established its presence in varying degrees of development in a considerable number of cases of cerebral lesions in the region mentioned, the syndrome appearing either at the beginning, in a primary elective form, or as a residual condition or a restitution stage after the regression of a more complex clinical picture. A considerable number of competent observations have dealt partly with the syndrome of finger agnosia in the narrower sense and partly with its phenomenologic variants. The latter have already given occasion to the differentiation of clinical types of finger agnosia. Thus, Schilder undertook a subdivision into the following types, to each of which he attributed a distinct localizing value: finger agnosia (in the narrower sense), optic finger agnosia, constructive finger apraxia, apractic disturbance of finger selection and finger aphasia. Lange suggested a subdivision into the following varieties: an optic agnostic, a speech-ampnestic, a constructive apractic and a pure apractic form.

The clinical picture of finger agnosia is characteristic. A patient with this disability cannot orient himself with regard to the individual fingers of either hand (his own as well as those held out by the examiner). He cannot recognize them in any way corresponding to the normal; he cannot differentiate his fingers (thumb and index, middle, ring and little fingers) at all, or not fully; he cannot name them correctly, cannot indicate specific fingers on command and cannot imitate given finger postures of the examiner, and he commits striking errors in appropriate tests. This occurs in spite of the patient's theoretic knowledge of the hands and fingers, in spite of the absence of disturbance
of general optic and tactile comprehension, in spite of sufficient vision to guide him and in spite of the absence of any interfering motor or sensory disorders. It is noteworthy that mistakes with regard to the three middle fingers are usually more pronounced than those relating to the thumb and the little finger. The patient most often does not become aware of his errors spontaneously and is helpless in controlling them. The phenomenon of finger agnosia, representing a primary disturbance of recognition and orientation confined to the fingers of both hands, may also, according to the degree of its development, be accompanied secondarily by a certain lack of freedom in the individual actions of the fingers and by difficulty in their separate practical realization. As far as the limbs (including the toes) and the other parts of the body are concerned, ability to recognize them and to orient as to them remains essentially unaltered. It is as though, in finger agnosia the so-called body scheme, the postural model of the body—that is, the image which a person normally has of his body and the spatial relation of its parts—were affected by a focal cerebral lesion in one sphere only, and, indeed, the most significant, differentiated and vulnerable one—the sphere concerned with the individual fingers.

Closely bound up with finger agnosia, in my experience, is more or less extensive disturbance of the capacity for recognition of right and left and orientation as to laterality with respect to the patient's own body and that of others, particularly as regards the hands and fingers. This disturbance is confined to the body sphere exclusively; that is, it does not apply to the ability to distinguish right from left in space and with respect to objects outside the body. Although finger agnosia is more often shown in tests requiring distinction between right and left, the symptom manifests itself irrespective of whether laterality is being tested. However, involvement of appreciation of right and left renders the test for finger agnosia more difficult for the patient. Disorientation for right and left results in difficulty and uncertainty in the choice of sides for actions necessitating a conception of right and left—as, for example, when the patient is commanded to grasp or to point with the hands and fingers to contralateral parts of the body.

Finger agnosia and disorientation for right and left are commonly, or at least in the great majority of cases, associated with an isolated disability or inability to write—so-called pure agraphia. This may either involve writing of words only (verbal agraphia) or impair writing of letters (literal agraphia) as well. It appears peculiar to this type of agraphia that spontaneous writing and writing from dictation are as a rule considerably more disturbed than copying from a sample.

The fourth characteristic feature of the syndrome is an isolated disability or inability to perform calculations—so-called acalculia. This may involve only arithmetical operations with more or less complex
numbers, or it may incapacitate the patient in operating with even simple numbers. There is a corresponding disturbance of the ability to convert more complex numbers into simpler ones, or vice versa. The significance of the position of the digit within a given complex figure is not realized; accordingly, the patient is disoriented regarding the sequence and the decimal values of the digits within a figure.

The coincidence of finger agnosia and disorientation as to right and left, on the one hand, and agraphia and acalculia, on the other, is fairly understandable if one remembers what an important part is played by the individual fingers and their right and left laterality in acquisition of the functions of writing and calculating. The function of writing is inconceivable without the highly integrated level of morphologic and physiologic differentiation of fingers that has developed in man, and continuation of intact ability to write is incompatible with disintegration of this development. Fingers supply the first aid in learning to calculate, as is commonly known. The first arithmetical operations of children are performed on the fingers of each hand, while the toes do not take part. In the counting operations of primitive people, and probably in the whole system of numeration, fingers and hands seem to play an important role. It is significant in this connection, for example, that the word “digit” means both “finger” and any one of the Arabic numerals. This is undoubtedly not accidental. It suggests an intimate relationship between differentiation of fingers and calculation.

My observations have convinced me that occurrence of isolated agraphia and acalculia ¹ may be primarily, or perhaps even exclusively, a clinical peculiarity associated with finger agnosia and the accompanying disorders of directional selection (to right and left). I have, at least thus far, not observed the coincidence of disturbances of recognition, selection, naming and pointing with the individual fingers, as revealed in the phenomenon of finger agnosia, and disturbances of writing and calculating of another category, such as those usually associated with certain defects of an aphasic, apractic or allied type. However, this does not mean that in each case of isolated agraphia and acalculia the finding of finger agnosia with disorientation for right and left is inevitable, even if such a possibility, from my experience, cannot be wholly denied. At all events, it is essential in any case of isolated disturbance of the acts of writing and counting not to neglect search for the symptom of finger agnosia and for right and left disorientation (and other selections of direction).

¹ For investigators who dispute the validity of the distinction of isolated agraphia and acalculia and prefer to merge all disturbances of the acts of writing and calculating with other cortical disorders, it may be mentioned that in making this statement I mean not so much to express classificatory tendencies as primarily to draw attention to the combination of finger agnosia and agraphia and acalculia as manifested in an isolated form.
With the syndrome under discussion may be grouped various other clinical symptoms, such as constructive apraxia, amnestic reduction of word finding, a certain, usually insignificant, disturbance of the capacity to read, impairment of color perception, absence of optokinetic nystagmus and disturbance of equilibrium. Except for constructive apraxia, these manifestations, because of their relatively variable occurrence and the proportionately slight degree to which they are found (as compared with the cardinal symptoms of finger agnosia, disorientation for right and left, agraphia and acalculia), can undoubtedly be regarded as arising from involvement of border or neighborhood tissue. The simultaneous occurrence of right homonymous hemianopia or hemiambylopia appears to be a constant feature.

The general psychic condition of a patient with the typical syndrome of finger agnosia and associated symptoms is remarkably good. The patient is usually cooperative, alert and mentally clear. Except for the reflected influence of the syndrome, the intelligence is essentially unaltered, unless an intercurrent cerebral lesion interferes. The patient is correctly oriented for place and person. However, he may be more or less disoriented for time. This disturbance, which is in remarkable contrast to the patient's general mental condition, is to be considered merely as a result of his disability to calculate and comprehend numbers and their handling. The ability to calculate seems to me to be an indispensable prerequisite for proper orientation in time. The personality as a whole is primarily intact. There is impairment only of a special basic function, a special tool in the service of the personality. The basic disorder underlying the various manifestations of the syndrome remains hypothetic.

In my first case of finger agnosia, that of a woman aged 52 who previously had suffered a cerebral accident, I concluded that a circumscribed softening in the lower part of the left parietal lobe, namely in the angular region, was probable, without, however, being able, in the absence of an autopsy, to make a more exact localization at the time. This assumption was soon confirmed by Herrmann and Pötzl in a case of tumor of the brain in which an autopsy was performed. In this case, in which the complete syndrome had been shown, the parieto-occipital region, particularly the angular gyrus and its area of transition to the second occipital convolution, was the seat of the lesion. Since then, the observations made at autopsy, both by me and by other investigators, in a series of cases of this syndrome, have established and corroborated the localization of the lesion in the region of the lower part of the parietal lobe and the middle occipital convolution directly adjoining. In the cases in my own observation in which autopsy was performed, the syndrome under discussion was present in typical form, and a few may be cited.
The first case was one of cerebral glioma involving a considerable portion of the parieto-occipital convexity, with complete destruction of the transitional region between the angular gyrus and the middle occipital gyrus. In a second case, a focal cerebral softening of several months' duration involved this transitional region; the onset had practically coincided with the appearance of the symptom complex. In a third case a glioma, approximately the size of an orange and soft for the most part, was located in the parieto-occipital region, the damage extending to the posterior part of the lower left temporal convolution. In a fourth case a focal softening was confined to the region of the left angular gyrus and the area of transition to the middle occipital convolution.

Other examples could be cited. It may be emphasized that in all cases autopsy confirmed the clinical diagnosis of a focal lesion in the region of the lower part of the parietal lobe and the region of transition to the occipital lobe.

It can accordingly be stated (with the reserve appropriate to an interpretation of localization) that the syndrome of finger agnosia, disorientation for right and left, agraphia and acalculia must be considered as related to a lesion of a common apparatus in the region of the parieto-occipital convexity, particularly in that part which is represented by the transitional region of the angular and the middle occipital convolution.

A survey of my own material and that of others reveals that the development of the syndrome differs, presumably in correlation with the extent of the focal lesion. Indeed, two forms of manifestation can be distinguished: a primary and a secondary. In the first type there is direct primary development of the syndrome. In the other type the clinical picture is dominated first by a more extensive complex of signs and symptoms; only after a certain regression of these symptoms does the syndrome of finger agnosia and its related disturbances become apparent—as if it had previously been concealed by too many other changes; the syndrome thus presents itself, in the second type, as a restitution stage in a more complex clinical picture, in which formerly other features had prevailed. I have repeatedly observed cases in which, after an apoplectic seizure, definite sensory, or pseudosensory, aphasia (in combination with apractic, tactile agnostic and alexic manifestations) was first seen, and later, after gradual recovery from the sensory aphasic disturbances (with extensive restoration of the reading capacity) and decline of other changes, the symptom complex of finger agnosia became manifest and remained as a residual condition, together with right homonymous hemianopia, which had existed from the beginning. In all these cases it was noteworthy that at the height of the aphasia, in tests for execution of oral commands or naming of objects, the disturbance was most pronounced when the individual fingers of either hand were concerned. This dissociation with the results in carrying out other commands and in naming other objects (even other parts of
the body) was striking. After recovery from the aphasia and appearance of the finger agnosia it became evident that the finger agnosia had existed from the beginning but had not been recognizable because it had been concealed by sensory aphasic manifestations.

Evidently, the primary or secondary appearance of the syndrome of finger agnosia in the cases referred to was dependent on the extent and the activity of the parietal or parieto-occipital lesion. In the one group the focal lesion may be less severe and may be confined mainly to the transitional region of the angular and the second occipital convolution. In the other group the process may be of greater intensity and at first more extensive, affecting also the parietal or the parieto-temporal region. At all events, it may be assumed in the case of the second group that the accentuated effect of the lesion in the region of transition of the lower part of the parietal lobe and the middle occipital convolution represents the topical factor, which is of determinative importance for the appearance and the frequent persistence of the syndrome. It can generally be said that the more limited the focal lesion (provided it is appropriately situated), the more suitable the conditions for the syndrome to appear electively. In other words, the basic function underlying the syndrome will alone be affected. In this case, the syndrome will dominate the clinical picture from the beginning. The more extensive the focal lesion, the more will other pathologic (even gross) manifestations result and conceal the finer syndrome of finger agnosia with disorientation for right and left, agraphia and acalculia. Only with recovery from the massive clinical manifestations will the more differentiated symptom complex become apparent, and finally dominate the picture.

The close relation of the phenomena constituting the syndrome is not only topical, but evidently genetic and pathophysiologic as well. One must, therefore, postulate a uniform pathophysiologic alteration corresponding to the uniform localization. This aspect of the problem is not yet solved. It culminates in the question of what damage to function consolidates the individual elements of the syndrome as a basic disturbance—as a fundamental unit. The solution of this problem has been attempted by various investigators with arguments of varying degrees of impressiveness. Yet it cannot be said that thus far a conclusive solution of the problem has been provided, however suitable the explanations may be for furthering comprehension of the pathophysiologic mechanism of the syndrome in many respects. Further investigations remain to be made.

The pathophysiologic basis of the syndrome is therefore, for the present, unsolved. However, the localizing value of the syndrome may
now be considered as proved. This statement is based on the observed material thus far collected, comprising partly cerebral tumors and partly focal cerebral softenings. In particular, the practical utilization of the syndrome in the local diagnosis of compressive lesions in the lower part of the parietal lobe or the transitional zone of the parieto-occipital region, respectively, should be emphasized. The symptom complex of finger agnosia has already pointed to the diagnosis of the site of a large number of tumors in the area of the brain under discussion, and on this suggestion surgical procedures have been defined with success. The value of this mode of localization has stood the test in a considerable series of cases of cerebral tumors in which the location of the lesion in the angular gyrus or the transitional region between the angular and the second occipital gyrus, respectively, was verified not only by biopsy but also by autopsy. In recapitulating actual experiences, it may be said that in cases of cerebral tumors the syndrome, when characteristically marked, has consistently proved itself reliable for purposes of topical diagnosis; when removal of the tumor was possible by operation the individual symptoms receded more or less completely in time.

The localizing value of the syndrome is significantly emphasized by the fact that the syndrome of finger agnosia is represented in the brain unilaterally, and that (as in aphasia and apraxia) it is associated with a correspondingly located lesion in the dominant side of the brain, that is, the left hemisphere in right-handed persons. The aforementioned case of Herrmann and Pötzl, in which the tumor was localized in the transitional zone of the right parieto-occipital region, is the only exception. It must, however, be noted that this case was that of an ambidextrous person. This suffices to explain the localization of the focal lesion in the right cerebral hemisphere, and at the same time decidedly reduces the seemingly exceptional significance of the case. Otherwise, both in the material which I observed and, as far as I know, in that studied by others, there have been only correspondingly located lesions in the left side of the brain.

In conclusion, one more statement may be made which has possible significance. I originally defined finger agnosia as a circumscribed disturbance of the capacity for recognition and orientation in one section of the body sphere only, a formulation expressed in the title of my first communication. There is no doubt that finger agnosia presents itself in

2. It is true that, some years ago, Klein reported a case of a clearly characterized syndrome of finger agnosia, disorientation for right and left and disturbance in writing and calculating in which at operation the tumor was observed in the middle part of the left parietal lobe (near the cortical border). One must assume here, however, that in the apparently extensive area of activity of the tumor the zone transitional in the parieto-occipital region was also involved.
this way.² It is noteworthy, however, as Schilder emphasized some years ago, and with whose opinion one must agree, that finger agnosia is the only disturbance of recognition and orientation with respect to the patient’s own body, as well as that of others, which can be found as a result of a circumscribed cerebral lesion. I have not yet observed undoubted disturbances of recognition and orientation with regard to other sections or limbs of the body, other forms of so-called autotopagnosia either of general nature or of isolated character, associated with a focal cerebral lesion,⁴ although I have sought them for many years. Evidently, except for finger agnosia, disturbances of recognition and orientation concerned with the rest of the body occur only with more expansive, particularly more diffuse, cerebral processes. The latter, moreover, usually result in psychic disturbances, in aphasic, apractic and other agnostic manifestations, behind which disturbances of recognition and orientation in the body sphere—extensive or limited—for the most part are not discernible. Finger agnosia, however, with disorientation for right and left and the other manifestations, is usually caused by a local lesion affecting the area of transition in the parieto-occipital region. The focal character of the cerebral lesion is the factor that explains the development of the syndrome and its isolation from other changes which might veil it or conceal its individual features.

BIBLIOGRAPHY

3. If one attempts to explain finger agnosia on the basis of the concept of the so-called body scheme, one might speak of a disturbance of the corresponding part of the body image, of a dissociation of the section of the body scheme appertaining to the fingers—as if the optic-tactile-kinesthetic image for the individual fingers were split off from the total body image, the finger scheme from the total body scheme.

4. Some years ago I had under my observation a hypertonic patient with clinical manifestations pointing to a focal softening in the left parietotemporo-occipital region in whom the discrepancy between the capacity for recognition and orientation with respect to the hands and fingers and that with respect to other parts of the body was conspicuous. While in this woman the finger agnosia, which was accompanied by a correspondingly intense disturbance of orientation for right and left and almost complete incapacity to write or calculate, was so marked that in repeated examinations not only did no correct reaction result, but occasionally (though sensibility was not disturbed) the individual fingers, and even the hands, were not noticed at all, nevertheless perception and orientation for the remaining parts of the body remained intact.


