

stimulus is very great is evidenced by the lack of neutrophilic polynuclear hyperleucocytosis where we should naturally expect it; that it is lasting is evidenced by the relative and absolute hyperlymphocytosis seen late after splenectomy.

## COMPLEMENTAL OPPOSITION

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I published some time ago a brief article<sup>1</sup> in which was described the method of employing a coordinated contralateral spinal reflex for differentiating between functional and genuine pareses of the lower extremities. This reflex was termed complementary opposition. Dr. Zenner, of Cincinnati, published later an account<sup>2</sup> of some clinical observations on genuine and functional pareses which confirmed my own observations. Dr. Zenner, however, said that he could not confirm my observations on normal subjects in detecting the contralateral opposition when the initial movement involved activation of the extensor iliofemoral muscles of one side; that is, if a patient lying on a couch is instructed to oppose one leg against the surface of the couch, thus activating the extensor iliofemoral muscles of that side, Dr. Zenner does not find complementary opposition manifested in the other thigh and leg.

It is true that the complementary opposition in response to an extensor movement is not as strong and never equals the initial resistance of the other side in vigor, but I always find under such circumstances that there is activation of the contralateral iliofemoral muscles. If the normal person is instructed to oppose one leg firmly against the surface of the couch we shall see either slight flexion of the opposite thigh on the pelvis; or, if the examiner's hand is placed under the tendo Achilles of the opposite side, he will perceive that the leg rests less heavily on the couch during the initial extensor movement and that sometimes the extended thigh and leg are lifted in the air.

Lhermitte<sup>3</sup> gives additional evidence of the constancy of complementary opposition in pareses due to anatomic lesions and also evidence of its modification in functional cases as described in my original publication. He finds also that complementary opposition is modified in paresis of a lower extremity induced during hypnosis, just as it is modified in malingerers and hysterical subjects. But Lhermitte observed in one case of functional spastic paresis of a lower extremity that complementary opposition was present on the opposite side when the patient made an ineffectual attempt to lift the spastic paretic leg off the couch.

He concludes, therefore, that complementary opposition is manifested in spastic functional paresis as it is in paresis due to an anatomic lesion. But this is only one-half the sign, for Lhermitte's own observations are convincing of the functional character of his patient's paresis, viz., when the patient was instructed to lift the sound leg off the couch, then the paretic side exhibited much stronger complementary opposition than was manifested by the sound leg when the patient made an ineffectual attempt to lift the paretic leg. This incon-

sistency I should accept as quite convincing of the functional character of the paresis.

Since Lhermitte's publication I have not had the opportunity to study a case of functional spastic paresis of the legs, but the same behavior of the reflexes can be demonstrated in any normal person who will undertake to simulate alternately a flaccid and spastic paresis of a lower extremity. For my observations I employed physicians who did not know what manner of reflex was being sought.

When a flaccid paresis of one leg was simulated there was no complementary opposition on the opposite side during the feigned attempt at lifting the flaccid limb. But when a spastic paresis of the iliofemoral muscles was simulated, then complementary opposition was apparent on the two sides respectively, as Lhermitte describes it in his case of spastic functional paresis.

The behavior of the two legs under such conditions I regard as further proof that this synergic movement is purely a coordinated spinal reflex. In the case of spastic functional palsy the patient really activated the flexor iliofemoral muscles in response to the order to lift the leg in the air, and consequently the contralateral reflex in the form of complementary opposition was exhibited. The attempt to lift the leg failed because the patient arrested the reciprocal inhibition of the extensor iliofemoral muscles, but the initial excitation of the flexor iliofemoral muscles was not wanting as a basis for the contralateral reflex movement in the extensor iliofemoral muscles.

This clinical sign is a practical application of the experimental observations on the spinal dog which Sherrington published in his book, "The Integrative Action of the Nervous System." The following description is given of an experiment on a dog whose spinal cord was transected in the upper cervical region: "In the flexion reflex of the hind limb excited by noxious stimuli, e. g., a prick or a Faradic current, the limb itself is drawn up—if weakly, chiefly by flexion at the knee; if strongly, by flexion at the hip as strongly as at the knee. At the same time the crossed hind limb is thrown into action, primarily in extension, but this is soon followed by flexion, and alternating extension and flexion is the characteristic result. The rate of this alternation is about twice a second; that is to say, the foot which has stamped on a thorn is drawn up out of the way of further wounding, and the fellow hind limb runs away, and so do the fore-legs, when—which is more difficult to arrange, owing to the height of the necessary spinal transection—they also are included, fairly free from shock, within the 'spinal animal.' By the 'spinal animal' he means an animal in which the cord is separated from the encephalon by transection.

Sherrington finds that in the dog a strong flexion reflex in one hind leg nearly always brings out an extension movement in the opposite hind leg. But he further says (p. 162, loc. cit.): "In the spinal rabbit, on the other hand, and less often in the dog, the crossed reflex from one hind limb to the other is sometimes not an asymmetrical movement but a symmetrical one. This seems to stand in obvious relation to the hopping mode of progression of the animal."

From Sherrington we learn that the irradiation of reflexes results in synergic movements which expresses coordinated reflexes in the animal's external life. These coordinated reflexes are acquired; they are not congenital. We have but to watch a child learning to walk to see how the want of these coordinated reflexes defeats

1. A new Sign for the Detection of Malingering and Functional Paresis of the Lower Extremities, THE JOURNAL A. M. A., Aug. 29, 1908, II, 746.

2. THE JOURNAL A. M. A., Oct. 17, 1908, II, 1309.

3. Semaine Médicale, Nov. 25, 1908.

the child's early endeavors. It is not until the synergic movements of both limbs are effected through coordinated spinal reflexes that the act of progression ceases to be attended with conscious effort. The act of walking, then, as it is finally learned, is dependent on the acquisition of adaptive coordinated reflexes. Although these coordinated reflexes express some purposive movement and comprise the integrative action of the nervous system, they are reflexes nevertheless, just as the simple tendon reflex or pupillary reflex which consist in the activation of three factors, viz., initiation, conduction and end effect. "The outcome of the normal reflex action of the organism is an orderly coadjustment and sequence of reactions."

This experimental view of synergic activity of skeletal muscles admits of very striking clinical application so far as the lower extremities are concerned. If complementary opposition is a purely spinal coordinated reflex, then in spinal diseases in which the "synapse" is affected or destroyed we must expect to find some modification of complementary opposition; and this I find to be a fact. In ataxic subjects who suffer from tabes dorsalis, and also in Friedrich's hereditary spinal ataxia, thus far I have always found that there is a disproportion between the strength of complementary opposition and the initial movement. If an ataxic subject is directed to hold one leg in the air against resistance we find that the other leg is opposed against the couch with much more force than is employed in the initial resistance; that is, the ataxic patient always overdoes the complementary opposition. This is true of patients with moderate degrees of spinal ataxia. But when the ataxia is extreme, when all kinesthetic impulses are interrupted, when the synapse is destroyed, we see quite another behavior. If such a patient is asked to close his eyes and then lift one leg off the couch there will be a symmetrical movement in the other limb; there is then no complementary opposition in such a patient when his eyes are closed. But if the patient is directed to open his eyes and then lift one leg off the couch, he will exercise complementary opposition in the other leg, but the opposition is stronger than the force of the initial movement. Such a patient with the aid of his sight behaves just as the patients in less severe cases behave with eyes closed or opened. An extremely ataxic patient with his eyes closed reacts similarly to the malingerer or hysterical patient, but for an entirely different reason. In the extremely ataxic patient complementary opposition is absent because of the loss of synapse, but in the hysterical subject complementary opposition is absent because of cerebral inhibition. If complementary opposition is a coordinated spinal reflex, then we should find it present in spastic spinal paraplegia; and this I find to be true.

The method of eliciting the initial activation of the flexor iliofemoral muscles of one limb is to give the patient a pin-thrust in the sole of the foot. If the paralytic patient is given a moderately strong prick with a pin on the sole of the foot the thigh is flexed on the pelvis and the leg is flexed on the thigh. If the pin-thrust is stronger, then the flexion reflex is stronger. Thus in genuine spastic paraplegic patients, or in those paraplegic patients in whom all reflexes are not lost, there is a constant relation between the intensity of the pin-thrust and the intensity of the flexion response. This would not be true in functional cases. Moreover, when the flexor reflex is elicited by the pin-thrust on one side we can feel that it is accompanied by activation of the extensor iliofemoral muscles of the other

side if the observer's hand is placed beneath the flexor tendons of the knee of the opposite side. The complementary opposition, it is true, is not strong; but neither is the initial reflex very strong, although the thigh and leg will be well flexed in a completely paraplegic patient if he is given a sharp pin-thrust in the sole of the foot. In a patient who had an acute myelitis with absolute paraplegia inferior with urinary and fecal incontinence and absolute loss of all sensations and all reflexes in the lower extremities, there was no such response to the pin-thrust in the sole of the foot for a very obvious reason.

Recently I employed this method of eliciting complementary opposition in a patient who suffered from paraplegia inferior after an injury. I shall mention only the facts which have a bearing on this sign. The patellar reflexes were both present, though diminished in intensity. There was absolute motor paralysis of both thighs and legs. To superficial stroking of the soles of the feet there was no response, but when firm pressure was employed in stroking the soles there was a dorsal flexion of all the toes, i. e., the response could be elicited through the protopathic paths but not through the epicritic paths. Directly after the accident the patient had priapism and marked disturbances in rectal and bladder innervation. When this patient was given a strong pin-thrust in either sole there was a good flexor response and it was accompanied by activation of the extensor iliofemoral muscles of the opposite side.

#### SUMMARY

To sum up the results of my observations: I think that we are justified in assuming that complementary opposition is a contralateral coordinated spinal reflex and is always present when the spinal synapse is not completely destroyed unless cerebral inhibition intervenes.

Moreover, we must observe in cases of functional spastic paresis of one limb (the iliofemoral muscles, inclusive) that the complementary opposition is present on the sound side because the patient activates his flexor iliofemoral muscles on the initial side, but through cerebral intervention he prevents the normal reciprocal inhibition of the extensor muscles of the affected side. Under such conditions the functional character of the spastic paresis is betrayed by the disproportion between the complementary opposition of the two sides respectively.

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## CARCINOMATOUS POLYPOSIS OF THE COLON

WITH REPORT OF AN INTERESTING CASE

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The very interesting character of the clinical manifestations and pathologic findings, combined with the apparent rarity of the disease in point, necessitate the presentation of our report before discussing the subject in detail.

#### AUTHORS' CASE

*Medical Part:* Dr. Niebruegge

*History.*—Miss A. M., aged 19, consulted me Aug. 1, 1908, complaining of a severe offensive, bloody diarrhea. The following data were elicited: The patient's mother's mother died from cancer of uterus. Parents were alive; mother healthy; father