The effect of cervical cord section of the cervical cord on hemiballismus

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Hemiballismus is a violent, uncontrollable movement of the arm and leg that is almost invariably unilateral. The origin of the term is somewhat obscure and was originally credited to Kussmaul by Oppenheim. However, Moersch and Kernohan were unable in their studies to verify this origin, and credit Jakob with this term suggesting the motion of tossing a ball by one side of the body.

Martin and Alcock, as well as Moersch and others, have verified the usual pathology to be a lesion of the contralateral subthalamic nucleus (corpus Luysii). Most observers are now agreed that the illness, if truly ballistic in nature and not hemichorea, is usually fatal because of exhaustion with terminal cardiac failure or pneumonia within a period that varies from 1 to 6 weeks in most cases. The etiology has been vascular, usually hemorrhage or thrombosis, in the great majority of instances; however, occasional reports have appeared of subthalamic involvement by a neoplastic or granulomatous process. Meyers, Sweeney and Schwidde believed that apparently bona fide cases of hemiballismus occur from involvement of the afferent or efferent pathways connecting to the corpus Luysii and possibly from pathology involving the corpus striatum and ventral neothalamus as well. The present evidence, however, is definitely clouded in attributing ballistic movement to locations in the basal ganglia and midbrain other than the subthalamic nucleus and its immediate projection pathways; certainly it appears that some case reports have confounded severe hemichorea with the pure ballistic movement. Meyers felt that there is some indication of somatotopic localization in the corpus Luysii with lesions rostrally causing movement of the head and neck, lesions of the middle portion affect-
ing the upper extremity, and of the caudal portion involving the lower extremity. Mettler and Carpenter have been able to produce complex involuntary movements by stereotaxic lesions of the subthalamic nucleus in *Macacus rhesus*; subsequently they modified or eliminated these movements by fulguration of various extrapyramidal projections, including the lenticular fasciculus, the medial segment of the pallidum, and large lesions in the lateral thalamic nucleus.

Recent surgical efforts to ameliorate or abolish hemiballismus have all uniformly implicated partial or complete interruption of the pyramidal pathways. At the cortical level Bucy extirpated areas 4 and 6, with a subsequent enduring left paralysis and apraxia. Meyers has noted relief by linear subpial section between areas 4S and 6 anteriorly and 4, 3, 1, 2 posteriorly. Other interruptions, by Talairach, Paillas and David at the capsular level and Walker by cerebral pedunculotomy, have likewise shown considerable pyramidal deficit. We have been unable to find in the literature any cases of pure extrapyramidal interruption similar to that carried out by Putnam in cases of chorea and athetosis until the present opportunity arose.

**CASE REPORT**

A 73-year-old white male was referred on March 3, 1953, for treatment of a violent hemiballismus of 5 days' duration. He was a known hypertensive of 12 years' standing and 6 years prior to admission he had had a minor cerebrovascular accident involving the right arm and leg, which completely cleared. Five days before admission he fell in his home, striking the occipital area; he was stunned and dazed but did not actually lose consciousness. The ballistic movements began immediately thereafter in the left arm, leg, and side of the neck. His family was not able to ascertain whether his stroke preceded the fall, or whether the reverse was the case. Within 24 hours the movements, at first gentle, became so violent that on several occasions he was thrown from his bed. They ceased completely with the sleep of exhaustion, but immediately returned with consciousness. For a few seconds at a time he was able to voluntarily control the movements, which then resumed with undiminished intensity.

**Examination.** The patient was conscious, cooperative, and somewhat restless. B.P. was 200/120, and pulse 86. The optic fundi showed grade II retinal sclerosis without hemorrhages, exudates, or choked disc. There was a severe hemiballistic movement involving the entire left side of the body, with very slight hypotonia and generalized reduction of reflex activity.