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Salvador Gonzalez-Cornejo

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## Chemothalamolysis in the treatment of hemiballismus — simplified Knighton's technique

Salvador Gonzalez-Cornejo, MD\*

*Three cases are reported in which the author used Knighton's simplified technique to make lesions in the ventrolateral nucleus of the thalamus. This controlled the involuntary movements of hemiballismus. One patient died of a myocardial infarction due to marked hypotension and an episode of postoperative bleeding in the upper gastrointestinal tract.*

HEMIBALLISMUS is a rare disorder in which violent uncontrolled movement of the arm and leg occurs. The origin of the term is obscure but was originally credited to Kussmaul by Oppenheim.<sup>1</sup> The flinging and hurling of the extremities usually persist throughout every waking moment. Although the movements disappear with sleep, sleep is usually impossible even with heavy sedation. The patient becomes distraught and eventually exhausted by the violent constant movements and frequently dies in a few weeks of pneumonia or cardiac failure.

Greiff,<sup>2</sup> in 1883, was the first to localize the lesion to the contralateral subthalamic nucleus of Luys. Whittier,<sup>3</sup> in 1947, was able to find 30 cases with adequate pathological studies of the subthalamic nucleus. In six of these the subthalamic nucleus was intact, but it was presumed that its connections were interrupted. In the majority of instances the lesion is vascular, either a hemorrhage or thrombosis, although occasional cases of neoplastic involvement have been reported.

Herz and Meyers,<sup>4</sup> in 1955, proposed a theory for the pathogenesis of hemiballismus in which impulses of the kinetic circuit flow from the periphery to the thalamus and are passed on to the postcentral areas 1, 2, 3, then by U fibers to the motor area 4 and 4s and premotor area 6. Kinetic impulses leave the motor cortex and pass by parapyramidal

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\* Professor of Neurosurgery, Graduate School, Division of Neurological Surgery, University of Guadalajara, Guadalajara, Mexico

Address reprints to author at this address.

fibers through the subcortical nucleus, probably including the reticular substance, to the lower motor neuron. The kinetic circuit, when unopposed by a suppressor circuit, produces ballistic movements of the opposite half of the body. Clinically, the majority of patients are elderly. The average age in Whittier's series was 64. As a rule the onset is sudden. Hypertension and arteriosclerosis are usually present.

All authors on this subject have emphasized that hemiballismus should be treated surgically by early operation if these patients are to survive. However, such individuals are not good surgical risks, and the number of reported cases in which surgery has been performed is relatively small.

In 1944, Bucy<sup>5</sup> removed areas 4 and 6 with success. Meyers<sup>6</sup> successfully treated his cases by subpial resection of the U fibers in areas 4, 4S and 6. Walker<sup>7</sup> incised the cerebral peduncle. Talairach<sup>8</sup> produced interruptions at the capsular level. Alpers and Jaeger<sup>9</sup> abolished movements by resection of the motor strip. All of these operations left the patient with some paralysis because of interruption of the pyramidal tracts.

In 1954, Brown and Walsh<sup>10</sup> reported a case in which hemiballismus was relieved by ventral quadrant section of the cervical cord at the C 2 level after the method used by Putnam in choreoathetosis. This interrupts extrapyramidal instead of pyramidal tracts and, when properly performed, does not produce paralysis.

In 1957, Cooper<sup>11</sup> reported the treatment of hemiballismus with lesions in the globus pallidus or in the pallido thalamic complex.

In 1959, Knighton<sup>12</sup> reported the results of his simplified technique to make lesions in the ventrolateral nucleus of the thalamus in 100 patients with parkinsonism. A burr hole is made 4 cm from the midline in the contralateral side and 14 to 16 cm behind the nasion corresponding to a coronal plane

passing through the temporomandibular joint. A specially pointed spinal needle, which is satisfactory for the placement, is directed without the use of a guide under x-ray control using a combination of ventricular and bone landmarks (Figure 1). The usual method of outlining the ventricular system is by fractional pneumoencephalography. The lesion is made by injecting a mixture of absolute alcohol and pantopaque. The site of the injection is marked with the contrast material (Figure 2). The radiographic and anatomical landmarks are demonstrated in figures 3 and 4, the target area being at 9 to 10 cm behind the lowermost part of the frontal inner table, 2.5 to 3 cm above the posterior clinoids, and 1 to 1.5 cm from the midline. This area corresponds to a midpoint between the anterior and posterior commissure, as is seen in the pneumoencephalogram.

We have used Knighton's technique in the treatment of three patients with hemiballismus.

## Case reports

**Case 1.** A 56-year old man, who was chronically hypertensive, suddenly developed ballistic movements in the right upper extremity which 48 hours later also involved the right leg. Left chemothalamolysis was performed, with immediate cessation of the involuntary movements. 48 hours postoperatively he had bleeding in the upper gastrointestinal tract. Marked hypotension led to myocardial infarction and death.

**Case 2.** An 80-year-old woman, a chronic diabetic, suddenly developed involuntary movements in her right upper extremity. Over a three-day period they involved the leg as well. The hemiballismus was predominantly in the leg. Left chemothalamolysis was performed 10 days after the onset with complete control of the ballistic movements (Figure 4).

**Case 3.** A 72-year-old woman, a chronic hypertensive and diabetic, suddenly developed hemiballismus with more involvement of the leg. Six weeks later, left chemothalamolysis was performed with complete cessation of the hemiballismus.

## Chemothalamolysis treatment of hemiballismus

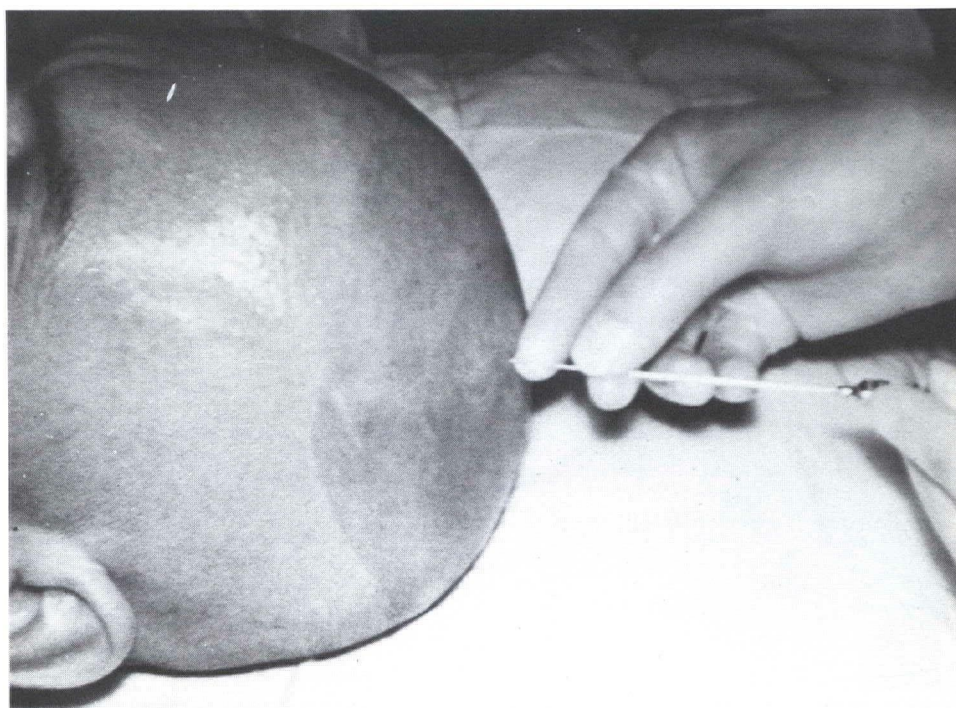
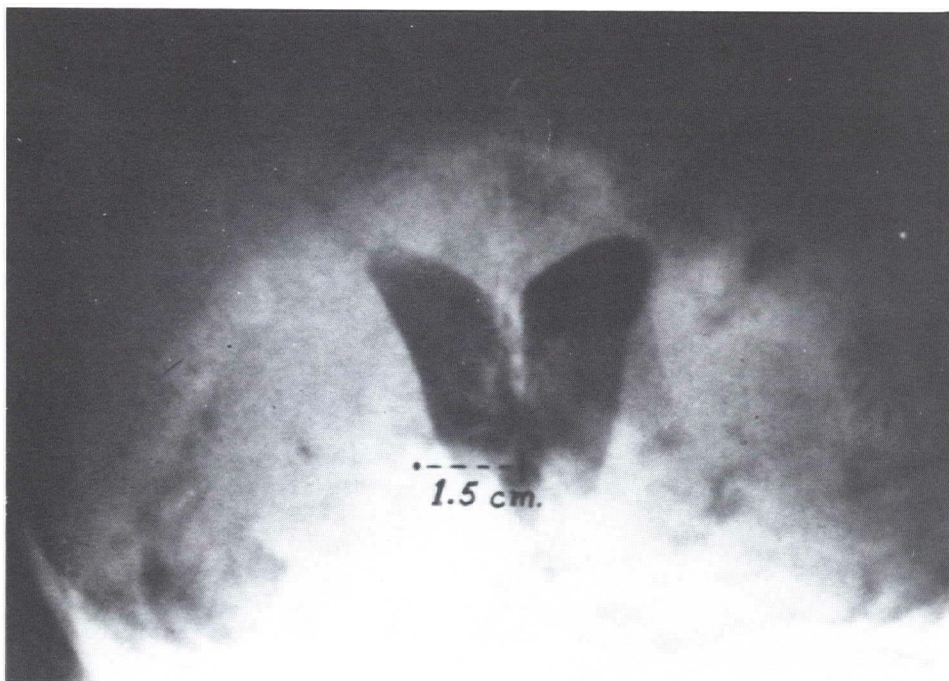


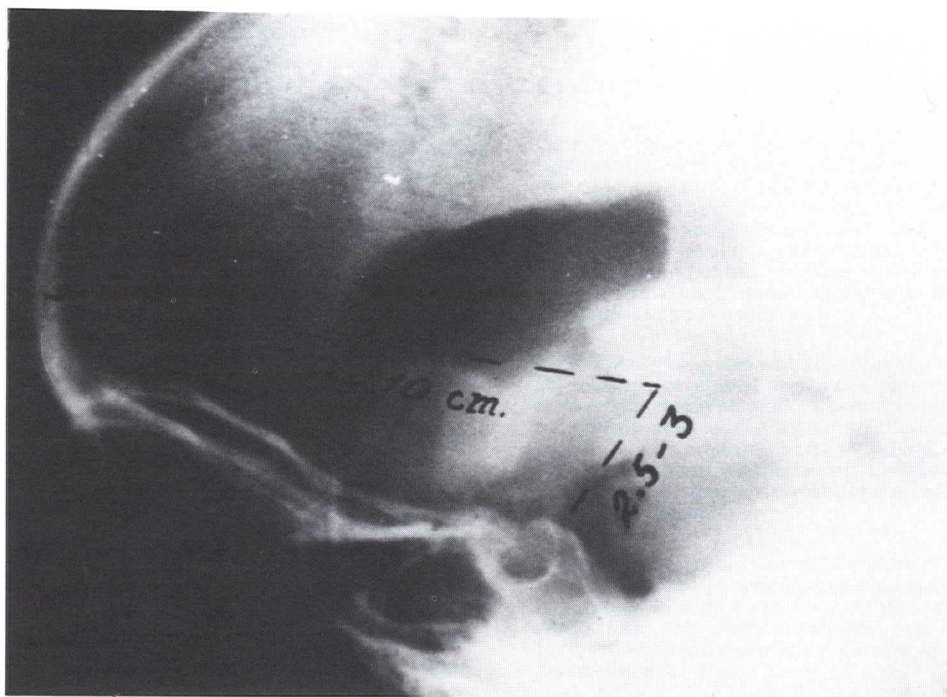
Figure 1

Placement of the needle using free hand method under X-ray control.





Figures 2 A above and 2 B below  
Radiographic landmarks for the target area.



## Chemothalamolysis treatment of hemiballismus

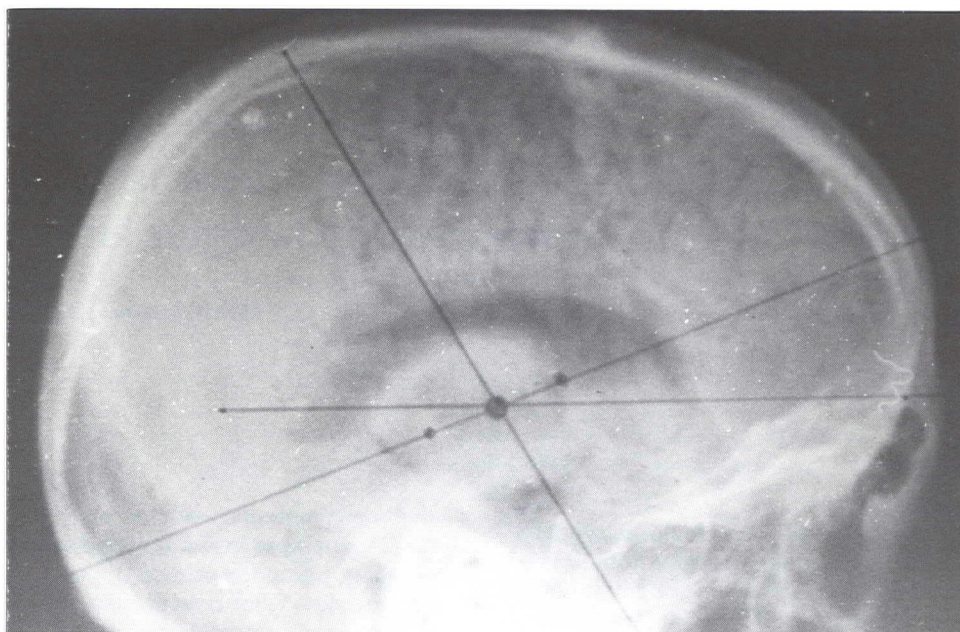


Figure 3  
Ventricular and bony landmarks.

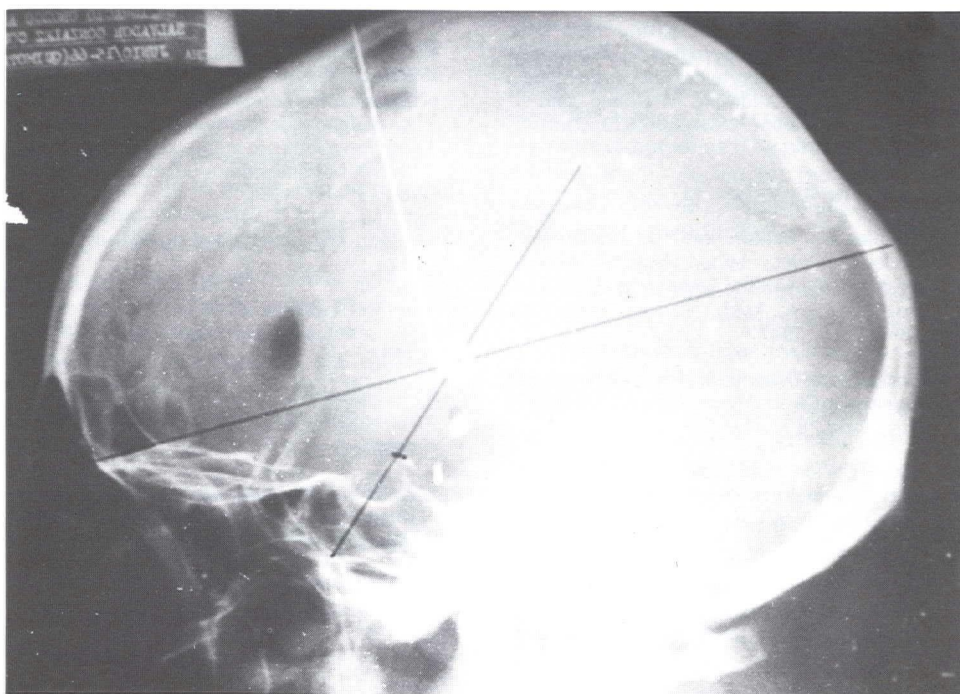


Figure 4  
Left chemothalamolysis in Case 2 with complete control of hemiballismus.



Despite some reports of spontaneous subsidence of hemiballismus, the prognosis is generally not good because most cases associated with an apoplectic episode occur in elderly people who are already debilitated before being subjected to this exhausting

disorder. We feel that surgical treatment is indicated. Knighton's technique is a simple and safe method to treat these individuals who certainly are not good risks for a more major surgical procedure.

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