

Cerebral Angiography and Egas Moniz

T. Doby¹

In the early 1920s, Egas Moniz, professor of neurology in Lisbon, Portugal, undertook a task no one really considered possible: the radiographic imaging of the brain in a living human subject. At the time, the only approach to visualizing cerebral abnormalities was Dandy's method of introducing air into the ventricular system. But what a crude method it was. What agony the patient had to endure, strapped to a chair, put in awkward positions, even turned upside down—yet the brain itself could never be seen, only the distorted ventricles. Moniz's supposition was that if he could introduce radiopaque material that would concentrate in the brain, the brain would opacity and be visualized on radiographs.

Bromine, atomic weight 80, had promise of showing up on X-ray film. Because bromides were used as sedatives, it was reasonable to believe that they accumulated in the brain. Moniz gave patients large doses of bromides orally, but the brain was not visualized on radiographs. He then decided to inject the drug into the carotid artery in an effort to outline the artery. The patients had headaches but tolerated the injection. However, the films remained blank. He then injected bromides in dogs. In the 15th dog, ramifications of the cerebral arteries were faintly detected on the films, and Moniz described this as a day of "great enjoyment" [1]; however, the human goal was still distant.

To study the cerebral vasculature, Moniz introduced bromides into the carotid and vertebral arteries of corpses. However, autopsy material was not available to him in sufficient supply to allow him to pursue his studies. The Anatomical Institute, which could have provided the necessary specimens, did not have X-ray facilities. Consequently, he arranged to have decapitated heads transferred in boxes from the Institute to his somewhat distant laboratory in another district of Lisbon by taxicab. The vessels were injected under his supervision, films taken, and then the gruesome cargo sent back to the Anatomical Institute.

Moniz continued to inject bromides into the internal carotid artery of patients, and in the sixth patient the intracranial vessels were faintly visualized for the first time. However, 8 hr later, carotid thrombosis developed and the patient died. Moniz was desperate. He summoned Almeida Lima (his chief associate and later professor of neurosurgery) and his full staff to discuss whether they should continue the investigations. After a long debate, the consensus was to go on, but with the use of iodides rather than bromides. Their thinking was that since iodine has an atomic weight of 127, iodides had a better chance of being seen on films. Also, they took care not to dilute the 5 ml of 22% NaI solution with blood during the injection.

They could take only three films in sequence, hand pulled, and the injections were made through cutdown.

In June, 1927, in their third case, portions of the internal carotid artery in the sylvian fissure were distinctly seen. Moniz was triumphant, and he left immediately for a meeting of the Society of Neurology in Paris, where he had done his postgraduate training. His work was greeted with great enthusiasm, and he was invited to present his method a week later in the French Academy of Medicine. Moniz spent the following years evaluating the procedure and supporting the findings with surgical or autopsy proof. Working day and night, he wrote 61 papers in the 4 years between 1927 and 1931 [2]. His first book on cerebral angiography was published in Paris in 1931 [3] with a preface by Babinsky, one of the prestigious neurologists of the day, in which he praised Moniz for his courage, daring, and enthusiasm. In 1949, Moniz received the Nobel prize, not for his work in angiography but for the introduction of frontal lobotomy [4], a procedure that was subsequently discarded.

Contrast materials have changed since Moniz's first intraarterial injections. Modern cassette changers and subtraction techniques are used now, and a number of other advances have been made. Recently, the availability of CT and MR imaging have greatly reduced the need for cerebral angiography, yet it remains indispensable in certain circumstances.

Among Moniz's other achievements, he performed the first pulmonary angiography through a cardiac catheter in 1931 [5], and he encouraged his countryman dos Santos to undertake extensive study of peripheral arteriography [1, 6]. Because his hands were deformed by severe gout, Moniz never made a single injection; yet with his determination and his superior intelligence, he helped launch a new radiologic discipline.

REFERENCES

1. Moniz E. *Confidencias de um investigador científico*. Lisboa: Atica, 1949
2. Moniz E. *Bibliografia científica e literaria*. Lisboa: Edição do Centro de Estudos Egas Moniz, 1963
3. Moniz E. *Diagnostic des tumeurs cérébrales et épreuve de l'encephalographie artérielle*. Paris: Masson, 1931
4. Nobel Foundation. *Nobel lectures in physiology and medicine 1942-1962*. Amsterdam: Elsevier, 1964
5. Moniz E, de Carvalho L, Almeida Lima P. Angiopneumographie. *Presse Med* 1931;39:996-999
6. Doby T. *Development of angiography and cardiovascular catheterization*. Preface by H. L. Abrams, Littleton, MA: Publishing Sciences Group, 1976

In preparation for the 1995 centennial celebration of the discovery of the X-ray, the *AJR* will periodically publish History Pages, which deal with events leading up to and occurring around the time of the discovery.

¹ 22 Cottage Lane, Cape Elizabeth, ME 04107. Address reprint requests to T. Doby.

AJR 159:364, August 1992 0361-803X/92/1592-0364 © American Roentgen Ray Society