Technical Notes

EMI Scan Density of Methyl Methacrylate

IRVING EHRLICH,[1] MORRIE E. KRICUN, AND CARLOS F. GONZALEZ

Methyl methacrylate is a self-polymerizing plastic currently used by neurosurgeons to secure bone flaps following cranioplasty and as a coating material following the correction of itracranial aneurysms [1, 2]. We recently encountered a case which prompted us to investigate the density of methyl methacrylate on computed tomography.

Case Report

A 54-year-old female presented with headaches. An arteriogram demonstrated a congenital aneurysm of the anterior communicating artery. No evidence of subarachnoid hemorrhage was documented. The patient underwent surgery, and the aneurysm was clipped and coated with methyl methacrylate. Because she did not fully recover consciousness, a CT scan was performed several hours after surgery. A localized area of high density was seen in the region of the aneurysm repair (fig. 1A). The high density area was attributed to a combination of methyl methacrylate and surgical clip. Five days later her condition worsened. A repeat CT scan revealed an increase in size of the high density area (fig. 1B). Opinions differed as to whether this represented enlarging hematoma or just methyl methacrylate, with the change in size attributed to patient position. The patient again underwent surgery and a small amount of blood was found in the region of the previous surgery. Follow-up CT scan 1½ months later showed disappearance of the high density area consistent with resolution of the hematoma (fig. 1C).

Density Determination

A phantom was made consisting of a 3.5 cm diameter cylinder of methyl methacrylate 3 cm long in a plastic container immersed in a larger container filled with vegetable protein-based gelatin. Scans of the phantom were performed at various levels using the EMI Mark I scanning device with its standard 13 mm collimator, 160 × 160 matrix, and exposure factors of 120 kV at 33 mA (fig. 2).

The methyl methacrylate was found to be nonhomogeneous with a mean density of 19.5 EMI units and a standard deviation of ± 6.4. This is similar to the densities of liquid blood (13–28 units) [3] and gray matter (18–30 units) [4]. The gelatin was fairly homogeneous with a mean density of 34 ± 1 EMI units. The density of clotted blood varies from 37–40.5 units in vitro [5] to 27–38 units in vivo depending on the age of the hematoma (28 min–4 days) [3].

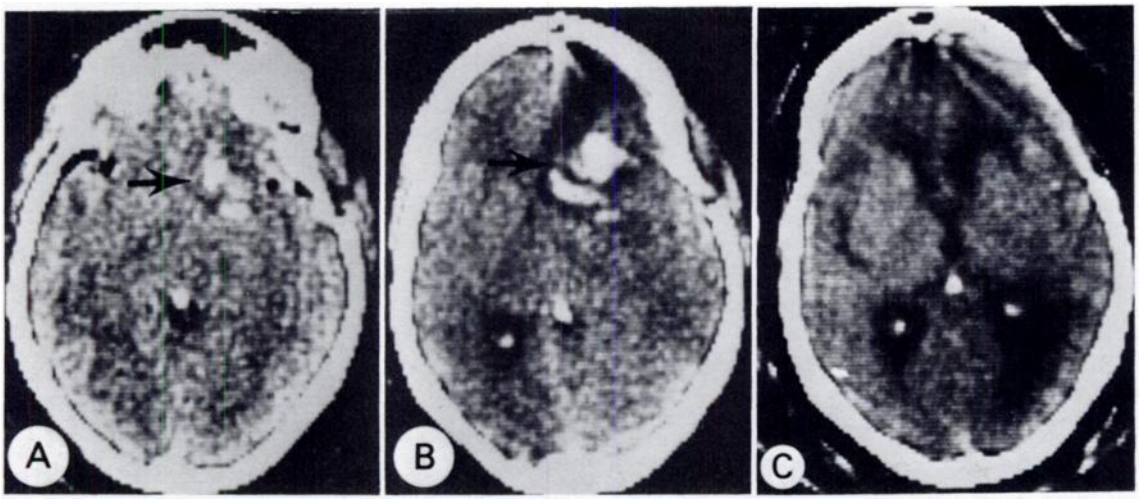

Fig. 1.—*A*, CT scan showing high density area in frontal region (*arrow*). *B*, Scan 5 days later at slightly higher level showing enlarged high density area (*arrow*). *C*, Follow-up scan 1½ months later. High density area has resolved.

Received August 18, 1976; accepted after revision April, 11, 1977.

[1] All authors: Department of Diagnostic Radiology, Hahnemann Medical College and Hospital, 230 North Broad Street, Philadelphia, Pennsylvania 19102. Address reprint requests to M. E. Kricun.

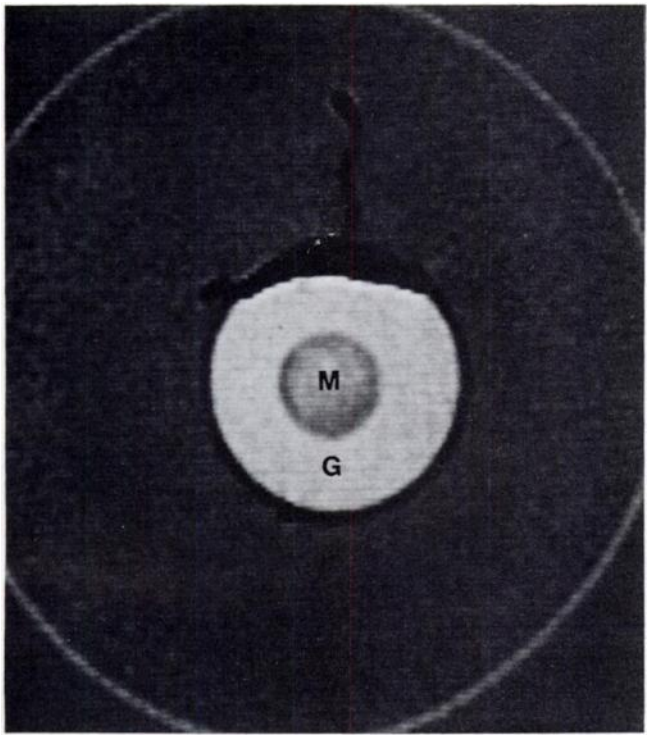

Fig. 2.—CT scan through phantom at level of methyl methacrylate. M = methyl methacrylate, G = gelatin.

Thus methyl methacrylate cannot be differentiated from brain tissue by CT because they have similar densities. In a postoperative situation where methyl methacrylate has been used and a mass is discovered of higher density than brain tissue, the mass should not be considered methyl methacrylate.

ACKNOWLEDGMENT

We thank Elizabeth Fry for secretarial assistance.

REFERENCES

1. Chou SN, Ortiz-Suarez HJ, Brown WE Jr: Technique and material for coating aneurysms. *Clin Neurosurg* 21:182–193, 1974
2. Hayes GJ, Leaver RC: Methyl methacrylate investment of intracranial aneurysms: a report of seven years experience. *J Neurosurg* 25:79–80, 1966
3. Scott WR, New PFJ, Davis KR, Schnur JA: Computerized axial tomography of intracerebral and intraventricular hemorrhage. *Radiology* 112:73–80, 1974
4. New PFJ, Scott WR, Schnur JA, Davis KR, Taveras JM: Computerized axial tomography with the EMI scanner. *Radiology* 110:109–123, 1974
5. Phelps ME, Hoffman EJ, Ter-Pogossian MM: Attenuation coefficients of various body tissues, fluids and lesions at photon energies of 18 to 136 KeV. *Radiology* 117:573–583, 1975