A Patient With Cerebral Arteriovenous Malformation and Multiple Metallic Pulmonary Particles*

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A 37-year-old woman was admitted to the hospital for evaluation and treatment of a large cerebral left hemispheric arteriovenous malformation. The arteriovenous malformation was diagnosed 19 years earlier when seizures occurred. She was initially treated with carbamazepine, phenytoin, and phenobarbital. A few years later a right hemiparesis developed, which subsequently improved with treatment. One year before admission, again a progression of the hemiparesis was noticed. Otherwise, the patient's medical history did not disclose any other abnormalities. At the time of admission, the patient was in good health. The vital signs were normal. The physical examination of the chest was within normal limits. Except for a partial right hemiparesis the other physical findings were normal. All the laboratory data were within normal limits. The ECG was noncontributory. A posteroanterior chest roentgenogram disclosed randomly distributed, equally sized spheres (1 mm in diameter) of metallic density throughout both lungs (Fig 1).

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Figure 1. Radiograph of the chest.
Diagnosis: Pulmonary embolism with spherical opacities of metallic density as a complication of a previous transcatheter embolization of a left hemispheric cerebral arteriovenous malformation

When encountering multiple metallic pulmonary densities on a chest x-ray film, the physician's first consideration is whether the densities are located in the tracheobronchial tree (ie, aspiration) or in the vascular compartment (ie, embolization). Material in clumps with a basilar distribution, similar deposits in the trachea and the gastrointestinal tract, as well as observed clearing with time, all support an endobronchial location. On the other hand, an equal distribution, material within the right side of the heart and within the systemic circulation (paradoxical embolization through a right-to-left shunt), as well as a lack of diminution over time all favor a vascular location. Shrapnel injuries may show a similar distribution as embolized particles, but angular margins help to distinguish this condition from the previously mentioned condition.1

When intravascular metallic densities are suspected, accidental or intentional injection of mercury2,2 or a complication of an intravascular embolization procedure should be considered.3 Extravasated mercury at the injection site and variable particle size suggest mercury injection.4

A history of therapeutic embolization of an arteriovenous malformation suggests pulmonary embolization of the particles used.5 The symptoms of this complication include cough, dyspnea, pleuritic chest pain, bloody sputum, or a drop in PaO2. It may, however, be asymptomatic. Intravascular transcatheter embolization is used in the preoperative management of arteriovenous malformations when the risk of hemorrhage at surgery is high or as a sole technique when surgery is not possible. A variety of types of agents are available to provide either a short-term or a permanent vascular occlusion. Short-term occlusive materials include vasopressin (antidiuretic hormone), autologous agents (ie, blood clots, fat, muscle, and connective tissue), and a material composed of a gelatin sponge that is absorbed within days to weeks (Gelfoam). Among permanent occlusive agents are various uncoated or coated metallic coils which induce local thrombosis, (an inert compressible form of polyvinyl alcohol sponge (Ivalon), detachable balloons, thrombin, absolute alcohol, and various polymerizing agents, the most commonly used being isobutyl-2-cyanoacrylate and n-butyl-2-cyanoacrylate, which begin to polymerize and gel when contacting an ionized substance, such as blood or ionic contrast material. Radiographically acrylate particles will present as amorphous spots of very high density almost equal to metallic particles. Flow-arrest techniques are thought to minimize the risk of pulmonary embolization.

Our patient underwent embolization 19 years ago when steel spheres were still used.6 During and after the procedure, no respiratory symptoms developed. The complication was noticed on the subsequent roentgenogram. During this admission, the patient underwent embolization again and no further complications occurred. The hemiparesis improved.

Pulmonary embolization as a complication of therapeutic transcatheter embolization of arteriovenous malformations is well known. With increased use of such interventional techniques, this complication should be familiar to every physician. Consideration of this complication may be crucial in pulmonary compromised candidates for such procedures.

REFERENCES
1 Vas W, Tuttle RJ, Zylak CJ. Intravenous self-administration of metallic mercury. Radiology 1980; 137:313-15
3 Leitman BS, McCauley DI, Firooznia H. Multiple metallic pulmonary densities after therapeutic embolization. JAMA 1982; 248:2155-56