Intracranial Arteriovenous Malformation, Pulmonary Arteriovenous Fistula, and Malignant Glioma in the Same Patient

Case Report

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INTRACRANIAL arteriovenous malformations and pulmonary arteriovenous fistulas, existing as separate entities, have been diagnosed and reported with increasing frequency since the advent of angiography.1-3 Intracranial arteriovenous fistulas are commonly associated with other vascular anomalies; especially hereditary hemorrhagic telangiectasia.4,5,6,7,8,9,10,11 Pulmonary arteriovenous (AV) fistulas are commonly associated with other vascular anomalies; especially hereditary hemorrhagic telangiectasia.6 Chandler3 reported a family in which the daughter had an intracranial AV malformation and the mother a hereditary hemorrhagic telangiectasia with multiple pulmonary AV fistulas. However, no previous report of these pulmonary and intracranial vascular anomalies occurring in the same patient has been found. This is a case report in which both an intracranial AV malformation and a pulmonary AV fistula were demonstrated in a patient who also had a malignant glioma.

Case Report

A 21-year-old Negro man was admitted to a local hospital on August 5, 1966, because of a 2-month history of headache and vomiting. The past medical history and family history were both negative. The patient was somnolent and had papilledema. The chest x-ray revealed an area of increased density in the right pulmonary apex which was thought to represent tuberculosis. Spinal fluid examination revealed four lymphocytes and a protein of 170 mg%. Smears for acid fast bacilli were negative, but the clinical impression was that the patient had tuberculous meningitis. Anti-tuberculous therapy was begun, and, because of the alteration of consciousness, intravenous Mannitol was also administered with some temporary improvement. The level of consciousness subsequently deteriorated to a stuporous state, however, prompting transfer to the University Hospital on August 14, 1966.

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Examination. The patient was well-developed but moderately dehydrated and stuporous. The blood pressure was 110/80, the pulse 110 and regular. Clubbing of the fingers and mild cyanosis were noted. No telangiectasia were seen on inspection of the visible mucous membranes and skin. A bruit with systolic accentuation was heard over the right pulmonary apex. No bruit was heard on auscultation over the skull. Chronic bilateral papilledema was present. There was a left central facial paresis and moderate left hemiparesis. Reflexes were diminished throughout; no pathological reflexes were elicited.

Skull x-rays showed demineralization and some erosion of the right anterior clinoid and of both posterior clinoids. The chest x-ray revealed the previously described area of irregular increased density in the right pulmonary apex (Fig. 1 left). The hematocrit was 53, probably reflecting dehydration since it returned to normal with hydration. The electrocardiogram was normal. A bilateral carotid angiogram showed a left para-aortic AV malformation fed primarily from the left middle cerebral artery (Fig. 2). On the right a marked elevation of the middle cerebral complex was demonstrated along with some shift of the anterior cerebral artery from right to left. A large tumor stain with arteriovenous shunts and deep draining veins was identified in the right frontotemporal area.

It was apparent that the patient’s immediate problem was the intracranial neoplasm, which was thought to be a malignant glioma. Because of this, further diagnostic studies relative to the pulmonary lesion were postponed. Large doses of methylprednisolone were begun, to control the cerebral edema while the patient was being prepared for surgery. His level of consciousness improved considerably within the first 24 hours, and
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he was able to speak and carry out simple commands.

Operation. On August 16, 1966, a right temporal craniectomy was performed under general anesthesia. A large necrotic tumor extending to near the midline and involving the entire anterior temporal lobe was excised. Histological examination of this tumor revealed it to be a glioblastoma multiforme.

Postoperative Course. The patient showed rapid improvement in his neurological state and by the second postoperative day was alert and oriented with only a mild left hemiparesis. A left homonymous hemianopsia was present. A course (5000 r) of cobalt irradiation was begun.

A pulmonary angiogram was done in the postoperative period and this showed an AV fistula to be the cause of the right apical density which had been observed on the

Fig. 1. Left: Chest x-ray showing an area of irregular increased density in the right pulmonary apex (arrow). Right: Pulmonary angiogram demonstrates AV fistula (arrow) with large draining vein.

Fig. 2. Left carotid angiogram demonstrates parasagittal AV malformation being fed primarily from an enlarged middle cerebral artery. Left: Anteroposterior projection. Right: Lateral projection.
chest x-ray (Fig. 1 right). Pulmonary function studies were normal. Peripheral arterial oxygen studies revealed oxygen saturation at rest to be 85% and with 100% oxygen this only increased to 90% (normal is 100%). The p02 at rest was 55 mm Hg and with 100% O2, was only 168 mm Hg, the latter being very abnormal (normal is greater than 550 mm Hg). This indicated the shunting which was taking place; it was estimated that the pulmonary shunt involved 45% of the cardiac output.

The patient was last evaluated on December 8, 1966 (about 4 months postoperatively). At that time he was doing well and had no symptoms relative to either of the vascular anomalies. Examination revealed that the left hemiparesis had cleared but the left homonymous hemianopsia persisted. The bruit over the right pulmonary apex was unchanged and mild cyanosis of the nail beds was still present. Several weeks later, he became confused, belligerent, and unmanageable, and was admitted to the state mental hospital. He died there on February 22, 1967, some 6 months postoperatively; permission for postmortem examination could not be obtained.

Discussion

In considering the possible relationship between these two vascular anomalies it is important to review and compare their development. Tobin and Zariquiey12 showed that pulmonary AV fistulas are present in early embryologic life but are usually obliterated with the development of vascular septa when a distinct separation between the venous and arterial side of the system occurs. It has been suggested that failure of development of the vascular septa causes multiple small AV shunts.1 Some of these may enlarge to become pathologic AV fistulas. Since there is a fairly high incidence of other vascular anomalies, especially hereditary hemorrhagic telangiectasia, occurring with pulmonary AV fistulas, a generalized disturbance of the entire vascular system would seem possible. Since intracranial AV malformations do not occur with pulmonary AV fistulas, however, it appears that these lesions are of different origins. Their association in this case appears to have been fortuitous.

Further information, as presented by Padget,5 supports the hypothesis of a different origin for these anomalies. She suggested that intracranial AV malformations primarily involve abnormal arterial influx into a relatively large vein on the neural tube. She noted in embryos of about 20 mm that there are few places where the primitive veins are in contact with arteries and that most crossings are at right angles. At this stage, differentiation of the vessel walls has not occurred and veins and arteries are separated by, at most, a double layer of endothelial cells. After most cranial arterial walls become thickened, arteries and veins frequently cross and accompany each other. Therefore, she suggested that these right-angle crossings might be of importance in preventing abnormal vascular connections prior to differentiation of the arterial wall. Padget also suggested that if a primary fistula does develop in the embryo, secondary dilatations in the form of aneurysms could develop because subsequent venous development is characterized by considerable shifting, added and subtracted anastomoses, and even reversals of flow.

The coexistence of AV malformations and aneurysms has been reported; the Cooperative Study of Intracranial Aneurysms and Subarachnoid Hemorrhage5 stated that 6.2% of AV malformations coexisted with one or more aneurysms but only 37% of the aneurysms were located on a major feeding artery to the AV malformation.

Since pulmonary AV fistulas are uncommon lesions, it is worthwhile to review some of their diagnostic features. These vascular anomalies usually are attended by the clinical triad of cyanosis, exertional dyspnea, and digital clubbing with the symptoms generally being manifested in the third decade of life.4 Telangiectasia in the skin or visible mucous membranes is found in more than half of the cases and is a valuable clue to the diagnosis. Bruits are commonly heard over the fistulas, which in most cases are located peripherally in the middle or lower lobes and may be multiple. The most important sign in the diagnosis of such a pulmonary lesion is the finding on the x-ray film of a shadow in the lung fields, as in this case. Tuberculosis, fungus infections, bronchogenic carcinoma, and other intrathoracic tumefactions must be considered in the differential diagnosis. He
matologic and physiologic studies are important in the diagnosis since the physiologic abnormality is a right-to-left shunt. Hypoxemia with compensatory polycythemia frequently is present. Brain abscess has been reported as a complication of AV fistula. The diagnosis of pulmonary AV fistula can ultimately be confirmed by angiography.

**Summary**

A rare case has been reported in which an intracranial AV malformation and a pulmonary AV fistula were found in the same patient who also had a glioblastoma multiforme. The possible embryological etiology of these vascular anomalies has been discussed briefly as well as some diagnostic features of pulmonary AV fistulas. In this case there appears to have been a fortuitous association of lesions.

**References**