

The Middle Cerebral Artery Occlusion by a Metallic Pellet Embolus

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Abstract

A case is presented of a patient who experienced symptoms of cerebral ischemia due to the embolization of a metal pellet into the middle cerebral artery following a shot gun injury. The literature on this subject is reviewed and recommendations for therapy are given.

Key Words: *Cerebral infarction, embolus, foreign body.*

Introduction

Accidental cerebral artery embolization and occlusion by various elements have been documented, however, a migratory shot gun pellet embolus into the middle cerebral artery is an uncommon occurrence. The case presented here is unusual in terms of route of travel and time period of neurological symptom manifestation.

Case History

A 27 year-old white male prisoner was shot from a close range of 20 yards while trying to escape from a work farm. He received several pellet injuries into the anterior chest wall. He did not lose consciousness nor collapse to the ground. He was captured and taken to the prison cell where he was reported to be in good condition. The next morning, 10 hours after the injury, he complained of right-sided weakness and was noted to be lethargic.

He was brought to the emergency room for evaluation. On examination he was found to have several small pellet entrances into the anterior chest wall and the left temporo-parietal region. His vital signs were stable. Chest x-ray showed several metallic pellets in the anterior chest. One pellet was very close to the left pericardium and several were in the left lower lung field. There was no sign of cardiac nor pericardial abnormality. A small left hemothorax was noted. No other injury or any evidence of penetration of the skull was evident.

The patient was admitted to the hospital where a CT scan of the head, thorax and upper abdomen was performed. The proximity of the pellet to the left pericardium, without any evidence of pericardial penetration or cardiac tamponade, was noted. A few pellets were within the left lung. The remainder of the pellets were embedded in the skin. CT scan of the head showed a pellet lodged within the left middle cerebral artery (MCA) with infarction of the MCA territory suggesting occlusion of the MCA at the trifurcation. There was no intracranial hemorrhage. Three days after admission, the lethargy, right hemiparesis and slurred speech became more obvious. On the 5th day, an aortogram and carotid arteriograms were performed which showed impaction of the pellet into the trifurcation of the left middle cerebral artery with complete cut off of the blood supply distal to it. (Fig 1 & 2) There was retrograde filling of the MCA distal branches from the leptomeningeal and cortical anastomotic branches of the anterior cerebral artery. The aortic arch and both carotids in the neck were normal without evidence of injury.

During the next five days of hospitalization the patient regained his speech, however the decreased strength and sensation in the right upper and lower extremity persisted. Since no surgical procedure was contemplated and the neurological symptoms were stable, he was discharged from the hospital to be returned to the clinic and the rehabilitation program.

Discussion

Accidental embolization of foreign bodies to the peripheral arteries has been described in many instances^{1,2,3}. See table 1. It is uncommon for a pellet to reach the cerebral artery through a chest injury without any signs of deep penetration or thoracic internal injury. Embolism in a cerebral artery is clinically devastating, unlike peripheral vessels where

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Table 1: Summary of Cases In The Literature

AU-THORS	NO. OF PATIENTS	NATURE OF EMBOLUS	POINT OF ENTRY	DESTINATION	PROPOSED ROUTE
Kapp	2	a. high velocity missile	Chest and right cheek	Right middle cerebral artery (MCA)	Pulmonary vein, right heart and aorta
		b. grenade explosion (Metal fragment)	neck	Rt. MCA	Direct into the carotid artery
Vasick	2	a. metallic pellet	Head, neck, chest and abdomen	Rt. MCA	Direct through the ventricle
		b. Gun shot	Chest and abdomen	Rt. MCA	
Gilder	1	#2 buckshot	Head & neck	Left MCA	Common carotid artery?
Leone & Lhermitte	1	Shrapnel	Head, neck & chest	MCA	Vascular embolus
Dowzenko	1	Metal fragment	Right neck	MCA	-
Barrett	1	Shotgun blast	Neck	Left MCA	Neck to head
Gipe	1	Gun shot	Chest	Right MCA	-
Devkota	1	Metallic pellet	Chest	Left MCA	Pulmonary vein, left ventricle, aorta, Left MCA

the tolerance level is high. Depending upon the site of embolization, cerebral infarction may be unavoidable. The neurological deterioration occurs immediately after the occlusion of a major vessel if collateral vessels fail to restore adequate blood flow⁴.

In reviewing the literature it is found that most of these patients show immediate neurological deficit^{4,5,6}. In the present case, the development of neurological symptoms occurred ten hours after the initial injury. Also the portal of entries and final occlusion site were unusual.

Our case is unique in that the neurological symptoms did not manifest until ten hours after the initial injury and did not fully establish until after ten days following detection of the pellet into the left MCA. Also, the final destination was in the left side as op-

posed to the more common right side. As stated in the history, there was no deep penetration of the skull or neck. No arteries were injured. The portal of entry was the left lung. It is postulated that one of the pellets in the left lung travelled to the left ventricle via the pulmonary vein to reach the left MCA. In repeat radiographs here was no change in the number or position of the pellets.

The exact time period of the travel of the pellet into the left MCA is not known but occurred within ten hours of the initial injury. All cases reported in the past have shown lodgement of the pellet into the MCA artery, more commonly on the right side. This unique prevalence of the MCA embolization can only be explained in terms of a greater amount of blood flow as well as the larger caliber of this artery. The temporal branch of the MCA is less frequently occluded than the others. The anterior cerebral artery has escaped occlusion in the previous case results.

Theoretically, the metallic fragment which is left lodged into the arterial lumen may produce distal migratory thrombosis, extension of the infarction, erosion, hemorrhage, infection and formation of a mycotic aneurysm¹. Considering these complications, the pellets should be removed. However, factors such as the availability of a microvascular neurosurgeon, status of the neurological deficit, time interval between the injury and the proposed operation and other associated more serious injuries dictate the decision. Previous case reports have shown that the majority of surgeons prefer to remove the foreign body and this has been found to be beneficial in some cases in terms of neurological improvement. However, data from various reports do not show a

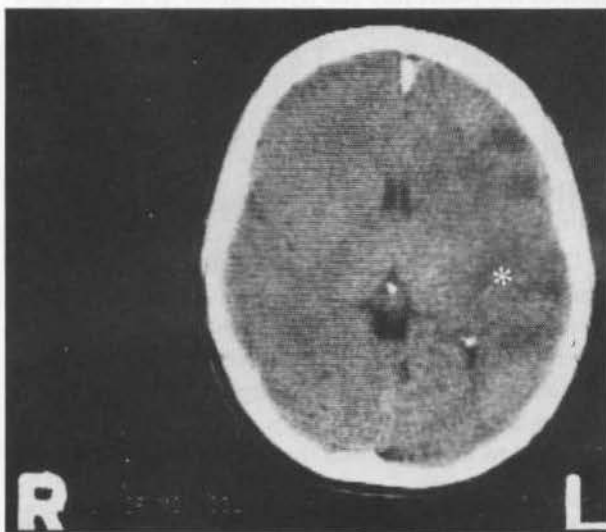


Figure 1A. CT scan of the head without contrast enhancement shows diffuse low attenuating area in the left hemisphere about the distribution of the left middle cerebral artery. No enhancement of this area noted following intravenous contrast administration (astrix).

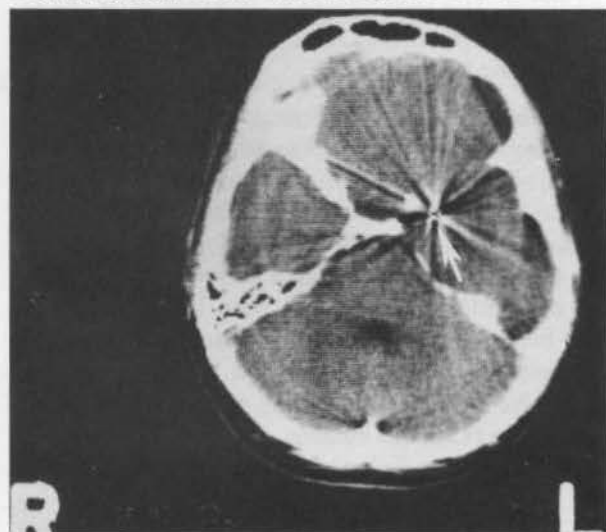


Figure 1B. A star artifact is seen in the left middle fossa due to metallic pellet lodged in the left middle cerebral artery (arrows).



Figure 2A. Anterior-posterior view of the left carotid arteriogram shows a metallic pellet lodged in the trifurcation of the left middle cerebral artery. There is cutoff of the blood supply distally due to complete block (arrow).

consistent difference in the prognosis for the patients with neurological deficit with and without foreign body embolectomy. Those cases which were operated upon show restoration of the distal blood flow through the anterior communicating artery and antigrade flow of blood beyond the point of occlusion. This may prevent ischemia in the marginal ischemic areas thus avoiding further extension of the infarction.

Conclusion

The migration of a pellet through the pulmonary vein to the left MCA is a rather unusual occurrence. Delayed neurologic manifestation is even more unusual after a close-range blast injury into the chest. The question of whether to remove the embolus or not is still a controversy. Even though the neurological symptoms do not consistently improve following surgery, several surgeons elect to remove the pellet in the acute state to prevent late complications.

References

1. Kapp JP, Gielchinsky I, Jelsma R: Metallic fragment embolization to the cerebral circulation. *J Trauma* 1973;13:256-261.



Figure 2B. Lateral view of the left carotid arteriogram shows a metallic pellet (arrow) in the left middle cerebral artery. There is no opacification of the distal branches of MCA, but good filling of the left anterior cerebral artery. (A delayed film showed retrograde filling of the distal branches of the MCA).

2. Keeley JL: A bullet embolus to the left femoral artery following a thoracic gun short wound. *J Thorac Surg.* 1951;21:608-620.
3. Kinmonth JB, Burton JD, Longmore DB, et al.: Gun shot wounds of the heart with embolism. *Br Med J* 1961;2:1666-1668.
4. Van Gilder JC, Coxe WS: Shotgun pellet embolus of the middle cerebral artery. *J. Neurosurg* 1970;32:711-713.
5. Vasic JM, Tew JM: Foreign body embolization of the middle cerebral artery. Review of the literature and guidelines for management. *Neurosurg* 1982;11:532-536.
6. Barrett NR: Foreign bodies in the cardiovascular system. *Br J Surg* 1950;37:416-445.
7. Dowzenko A: Rare case of embolus of median cerebral artery caused by foreign body. *Pol Tyg Lek* 1946;1:1045-1047.
8. Lecene P, Lhermitte J: Une observation anatomoclinique d'un cas de ramollissement cerebral consécutif à l'obliteration de l'artere sylvienne gauche par une embolie metallique. *Rev Neurol (Paris)* 1920;34:1116-1121.
9. Gipe BT, Aker B, Smith R: Delayed cerebral embolization of a shotgun pellet with fatal consequences. *J. Trauma* 1981;21:326-329.