

# Cerebral Perfusion Imaging in Asymptomatic Carotid Artery Occlusion Following Gun Shot

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Recognition of brain injury in asymptomatic carotid artery injuries with conventional methods can be difficult. We present a case of angiographically proven asymptomatic left internal carotid artery occlusion with normal CT after a gunshot wound. The SPECT brain perfusion imaging showed mild generalized supratentorial hypoperfusion of the bilateral cerebral cortices on the left side and severe left temporal lobe hypoperfusion.

**Key Words:** cerebral perfusion; traumatic brain injury; gunshot wound; technetium-99m-HMPAO

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Cerebral perfusion imaging by SPECT in ischemic cerebrovascular disease is well established (1-4). It is more sensitive than CT for detecting regional cerebral blood flow (rCBF) disturbances. The lesions are usually larger in size, and the abnormalities appear earlier than one would expect with CT (1,2). To establish a correlation between the patient's symptoms and rCBF disturbances, SPECT has been traditionally helpful as well as being useful after the progression or resolution of the abnormalities (3,4). We are presenting a case in which a man sustained a gunshot to the left cheek. In the cerebral CT no abnormalities were shown, but his cerebral angiogram revealed post-traumatic internal carotid artery thrombosis. The cerebral SPECT perfusion image showed mild generalized supratentorial hypoperfusion, which was more on the left side, and severe hypoperfusion in the left medial temporal region.

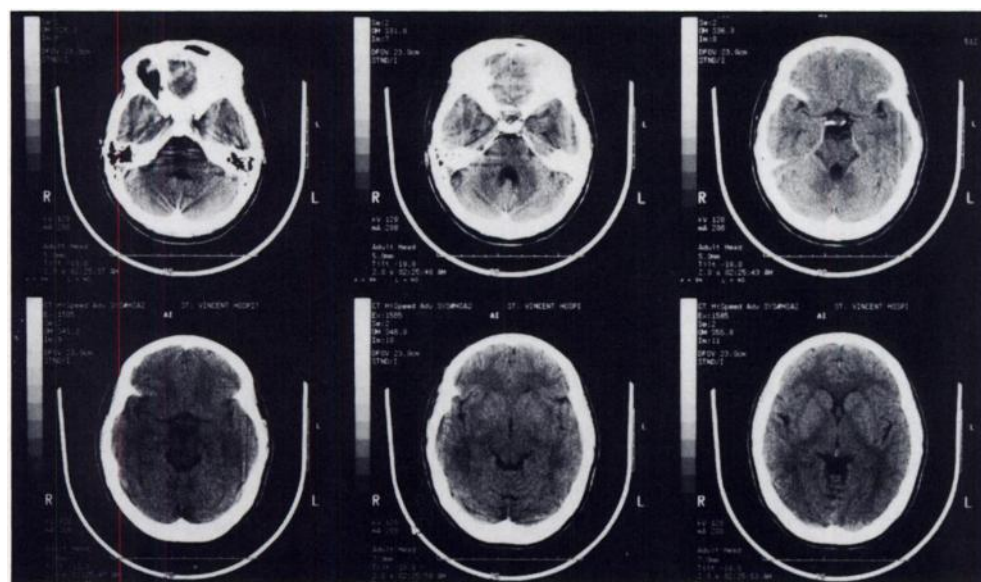
## CASE REPORT

A 23-yr-old man with no significant past medical history was admitted to St. Vincent's Hospital, NY, through the Emergency Medical Service after sustaining a gunshot wound to the left cheek. The physical exam in the emergency room revealed a combative man with a GCS of 13 who was intubated. There was a bullet entry site on his left cheek 1 cm below the inferior orbital rim. His pupils were equal and reactive to light and accommodation. He was hemodynamically stable and neurologically intact with no focal deficits or lateralizing signs. His emergency cerebral CT (Fig. 1) was normal. His sinus CT (Fig. 2) revealed a fracture of the lateral wall of the left maxillary sinus, a hematoma and bone fragments in the ethmoid and sphenoid sinuses, and a bullet was visualized in the left internal carotid canal. His cerebral angiogram (Fig. 3) revealed post-traumatic thrombosis of the left internal carotid artery near the skull base with a bullet in the vicinity. There was good filling of the external carotid artery branches on the left but no reconstitution of the left carotid siphon. His right internal carotid was normal, and there was filling of the anterior cerebral artery on the left by the patent communicating artery. His left vertebral artery was also normal. The basilar artery and its branches were also normal. There was a widely patent left posterior communicating artery through which there was a retrograde filling of the distal cavernous segment of the left internal carotid artery with good filling of the branches of the left middle cerebral artery.

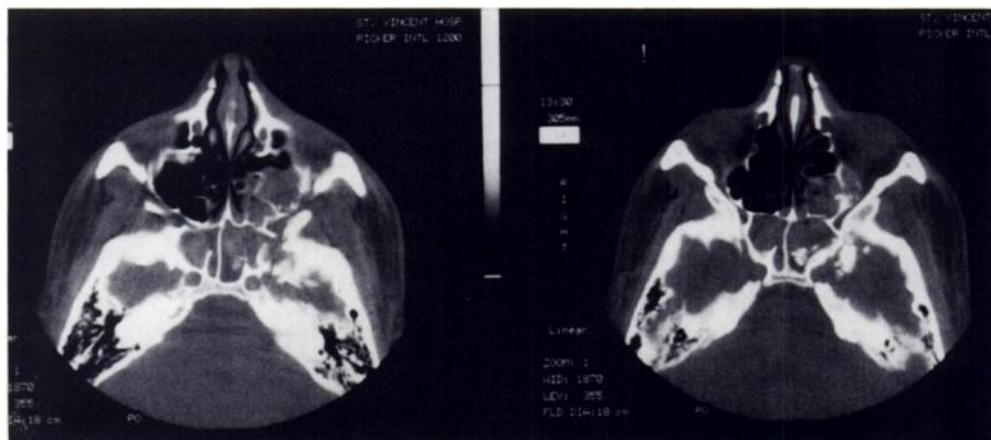
On the same day, our patient became less agitated and more oriented and, accordingly, was extubated. The following day he was alert and complained of frontal headaches, diplopia and decreased hearing on his left side with left facial numbness. Cerebral perfusion SPECT imaging (Fig. 4) was requested the next

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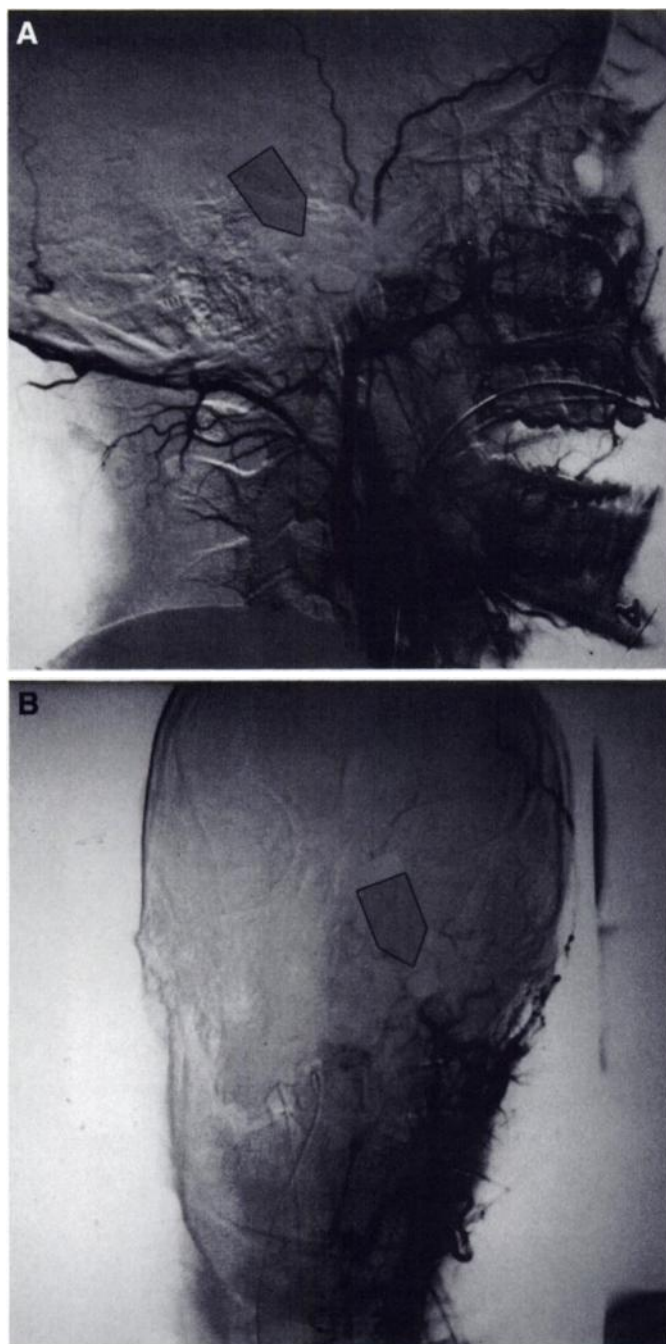
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**FIGURE 1.** Cerebral CT showing no abnormal findings.



**FIGURE 2.** Sinus CT showing a fracture and hematoma of the left maxillary sinus.



**FIGURE 3.** (A,B) Cerebral angiogram revealing left internal carotid post-traumatic thrombosis with a bullet in the vicinity (arrow).

day because of his neurological symptoms in the presence of a normal radiograph CT. His SPECT cerebral perfusion study revealed generalized decreased perfusion more on the left side. The medial temporal gyri of the left temporal lobe was severely hypoperfused, which correlated well with his symptoms of headaches and decreased hearing. He stayed in the hospital for 8 days. His symptoms greatly improved, and he left the hospital in stable condition. He was scheduled for a follow-up in the ophthalmology and ear, nose and throat clinics.

## DISCUSSION

Our case represents a complex neck injury consisting of both an obvious wound and an occult blunt injury that resulted in thrombosis of the internal carotid artery. Blunt carotid injury is a rare, but well-recognized entity, and it is often missed in asymptomatic patients. Blunt carotid trauma accounts for 3%–15% of all recognized carotid artery trauma (5). It is an under-recognized entity, and many cases are identified incidentally on thoracic aortograms or CT (6,7). It carries a morbidity and mortality ranging from 30% to 40% and 70% to 90%, respectively (6,8). The diagnosis of such injuries without physical signs can be difficult. Angiography of the neck vessels is indicated in such cases (8,9). A similar case of asymptomatic common carotid artery occlusion from a gunshot was reported by Yang et al. (9) who discussed the role of angiography and the indications for angiography after neck trauma. It is well known that the range of injuries from a gunshot are not limited to the track of the bullet. The energy transference from the bullet to the tissues causes widespread tissue destruction depending on the speed and momentum of the bullet, and thrombosis of vessels is one of the consequences that can complicate the patient's clinical picture.

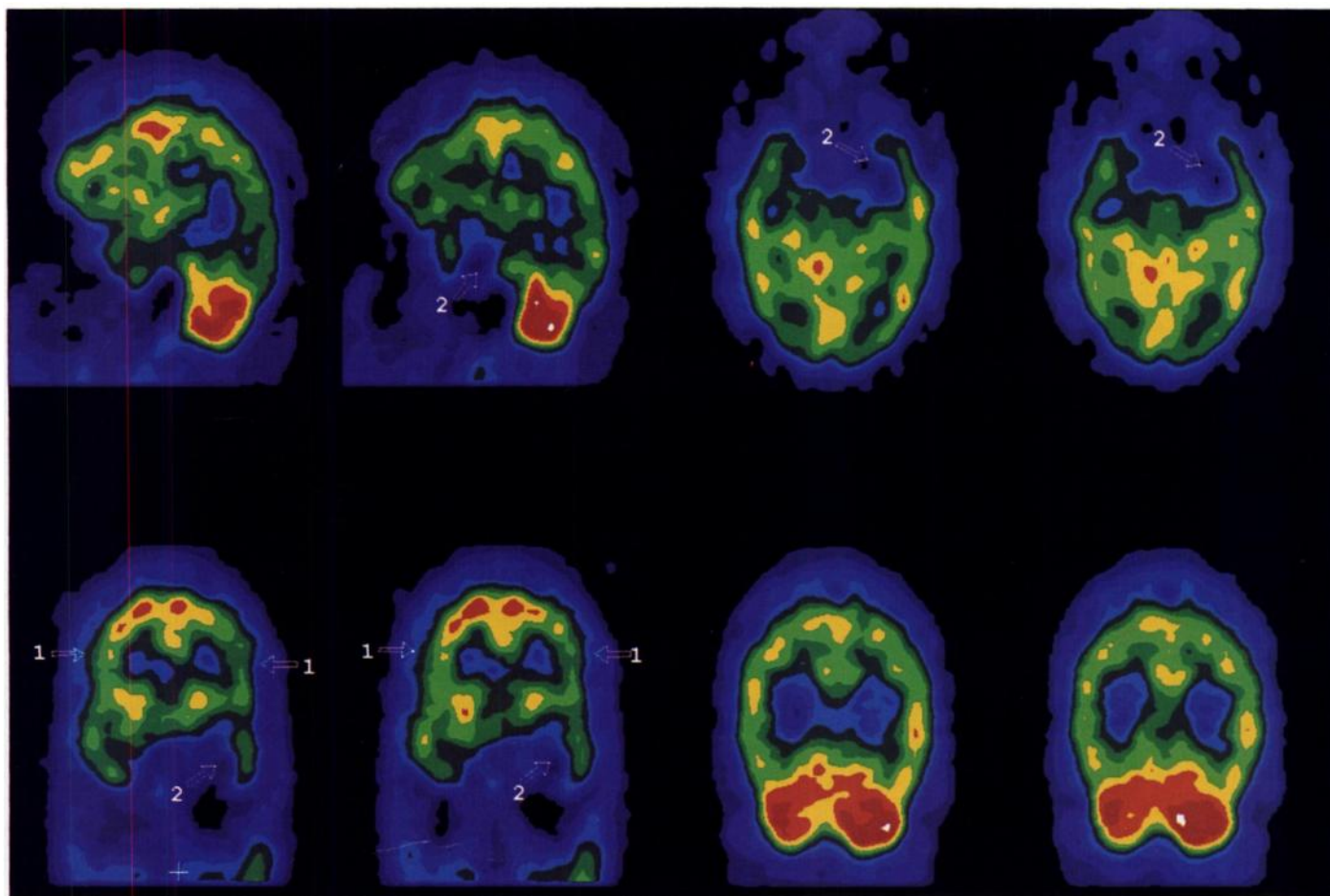
Our case illustrates the association of a penetrating neck injury with an unsuspected blunt injury to the carotid artery and its effect on cerebral perfusion.

Cerebral perfusion imaging by SPECT showed an abnormal finding of mild diffuse cortical hypoperfusion more on the left side with severe left temporal lobe hypoperfusion that did not show on CT. This finding reemphasizes the important role of cerebral SPECT imaging can play in patient evaluation.

## CONCLUSION

Asymptomatic carotid artery occlusion with a lack of lateralizing signs does not necessarily mean that a patient did not sustain a cerebral injury even if no injury appears on CT. We recommend that physicians, in similar cases, should be aware of the value of cerebral perfusion SPECT imaging and that it should be part of the patients workup before hospital discharge. The presence of any abnormal findings helps correlate the





**FIGURE 4.** Technetium-99m-HMPAO cerebral perfusion image color scaled for maximum uptake in the cerebellum showing mild generalized supratentorial hypoperfusion of the cortex, more on the left (arrow 1). The left medial temporal lobe is severely hypoperfused (arrow 2). There is mild decreased perfusion of the right cerebellum.

patient's complaints either after an accidental injury or in a future follow-up.

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#### REFERENCES

1. Van Heertum RL, Miller SH, Moisseff RE. SPECT brain imaging in neurological disease. *Radiol Clin North Am* 1993;31:881-907.
2. Yeh SH, Liu RS, Hu HH, et al. Brain SPECT imaging with  $^{99m}\text{Tc}$ -HMPAO in the early detection of cerebral infarction: comparison with transmission computed tomography. *Nucl Med Commun* 1986;7:873-878.
3. Launes J, Nikkinen P, Lindroth L, et al. Brain perfusion defect size in SPECT predicts outcome in cerebral infarction. *Nucl Med Commun* 1989;10:891-900.
4. Giubilei F, Lenzi GL, Di Piero V, et al. Predictive value of brain SPECT in acute ischemic stroke. *Stroke* 1990;21:895-900.
5. Troop BR, Carr SC, Hurley JJ, Pennell RJ. Blunt carotid injuries. *Contemp Surg* 1996;48:280-284.
6. Lebos MR, Saadia R. The overlooked blunt component in penetrating neck injuries: three case reports. *J Trauma* 1994;36:410-412.
7. Prete R, Reverdin A, Kalonji T, Faidutti B. Blunt carotid artery injury: difficult therapeutic approaches for an under recognized entity. *Surgery* 1994;115:375-381.
8. Krjowski LP, Hertzner NR. Blunt carotid artery trauma. *Ann Surg* 1980;191:341-347.
9. Yang X, Virtaniemi J, Vuorenniemi R. Asymptomatic carotid artery occlusion from gunshot. The role of angiography in penetrating neck trauma. *Eur Arch Otorhinolaryngol* 1995;252:440-442.