SCINTILLATION VISUALIZATION OF A VASCULAR RIM IN SUBDURAL HEMATOMA

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The value of scintillation visualization techniques for the detection of subdural hematoma is well established (1). The technique is simple to perform and incurs no patient morbidity or mortality. In a recent scintillation camera study, we visualized displaced cerebral vascular structures on both dynamic and static images in a patient later proven to have a subdural hematoma. The displaced structures appeared as a sharply defined hemi-elliptical rim of increased activity. We believe this rim sign is a significant addition to the clinical information available from scintiphotos of patients with subdural hematomas.

CASE REPORT

A 72-year-old male was admitted with right hemiparesis and deterioration of intellect. The patient had a history of chronic hypertensive cardiovascular disease but was able to engage in his usual activities until 1 week before admission. Initial examination suggested a tentative diagnosis of cerebral insufficiency with a possible parietal lobe lesion. The day after admission the patient was examined with the scintillation camera using 15 mCi of $^{99m}$Tc-pertechnetate (2). The dynamic study revealed no gross abnormality in the cervical carotid-vertebral circulation. The intracranial circulation showed an asymmetry of radioactivity, with a "cold" area initially seen along the left convexity (3). In addition, there was an adjacent area of abnormal uptake seen as a hemi-elliptical rim with its concavity directed toward the "cold" left convexity (Fig. 1). Early and delayed static images showed a crescent area of increased radioactivity conforming to the left convexity, consistent with a subdural hematoma (1). On both anterior and vertex projections, the static images also showed the hemi-elliptical rim passing in an anterior-posterior direction (Fig. 1).

The findings of an initially "cold" area developing into a crescent area of abnormal activity were interpreted as being compatible with a subdural hematoma. The appearance of the adjacent intracranial rim led us to suggest the possibility of radioactivity within the membrane of a subdural hematoma. A left carotid arteriogram followed and confirmed the interpretation of a left subdural hematoma (Fig. 2). Craniotomy was performed, and a left subdural hematoma, contained within a freshly organized membrane, was found. Postoperatively the patient became asymptomatic and with improvement in his mental status recalled falling off a ladder and striking his head 3 weeks before admission.

DISCUSSION

In our early studies we found that $^{203}$Hg-chlormerodrin localized in the subdural membrane and that the hematoma fluid was relatively free of radioactivity (1). Moreover, our findings with $^{203}$Hg-chlormerodrin confirmed previous studies of Sweet et al (4) and Mealey (5) who had noted higher concentrations of $^{74}$As- and $^{131}$I-labeled human serum albumin in the subdural membranes than in the fluid of hematomas. Our previous experience with $^{203}$Hg-chlormerodrin led us to interpret the rim visualized in this case as radioactivity accumulated within a membrane formed around a subdural hematoma. Review of the camera dynamic study revealed the appearance of the rim in the arterial phase with persistence through the capillary and venous phases. The pattern of the rim of radioactivity was similar to angiographic studies of patients with subdural hematomas (6). Therefore we concluded that the rim of increased radioactivity represented the displaced superficial cerebral vascular structures containing $^{99m}$Tc.

Our findings led us to review the pathophysiology of subdural hematomas. Aronson and Okazaki have described the response of the cerebral hemisphere to the presence of subdural hemorrhage (7). They noted impaired hemodynamics probably related to hemi-

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spheric swelling and incompetence of venous drainage. They also found dilated, congested and occasionally inflamed venous structures. We anticipate that the rim sign will be seen in other lesions that will similarly alter or displace the cerebral circulation, such as subdural hydromas, subdural empyemas, epidural hematomas and other “pseudo-subdural” hematomas (8). Because of the somewhat similar therapeutic approach in these conditions, however, this does not detract from the value of demonstrating this sign.

We have recently noted the rim sign on a rectilinear scan of another patient later proven to have an epidural hematoma. This was particularly interesting to us because we had concluded from our earlier experience with $^{203}$Hg-chlormerodrin brain scans that we could not directly visualize an epidural hematoma and that the positive scans in this disease were probably related to associated soft tissue trauma, bone trauma or underlying brain contusion.

O’Mara and coworkers have noted a central zone of decreased radioactivity surrounded by a rim of

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**FIG. 1.** Right shows dynamic scinti-photographs demonstrating appearance of vascular rim on arterial phase and lasting through venous phase (middle). Arrow points to rim. Note relative clear space adjacent to rim. Left top are static scinti-photographs in the anterior and (left bottom) vertex projections demonstrating rim sign. Note appearance of “crescent sign” in clear space seen on earlier dynamics.

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**FIG. 2.** Left carotid arteriogram demonstrating displaced arteries (left), appearance of capillary phase (middle) and demonstration of displaced veins (right). Note that “brain stain” is apparent after early arterial filling.
radioactivity, the “doughnut sign,” in certain intracerebral lesions such as metastatic carcinoma, intracerebral hematoma, abscess and cerebral vascular accidents (9). We would expect little, if any, difficulty in differentiating between the circular patterns disassociated from the convexity of the skull, and the convexity-related rim seen in our patient.

SUMMARY

We have presented a patient with a proven subdural hematoma who showed a rim sign on a scintillation camera study; this rim sign is thought to be due to vascular structures which contain pertechnetate and which are altered and displaced by the subdural hematoma. We have discussed the probable pathophysiology of this sign and have noted the difference between findings in subdural hematomas studied with $^{203}$Hg-chlormerodrin and with $^{99m}$Tc-pertechnetate.

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REFERENCES