COMPARISON OF AUTOFLUOROSCOPE BRAIN IMAGING WITH RECTILINEAR SCANNING AND NEURORADIOLOGIC EXAMINATIONS

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The digital autofluoroscope is a scintillation camera with a 15.2 × 22.9-cm rectangular array of 294 sodium iodide crystals.

Since the development of the digital autofluoroscope by Bender and Blau in 1960 (*1*), it has been used for static imaging and dynamic studies of various organs of the body (*2–5*). The Baird-Atomic model 5600 digital autofluoroscope had been used for static brain imaging at the Thomas Jefferson University Hospital from March 1967 to October 1970. There has been no previous comparisons between the Baird-Atomic autofluoroscope and the rectilinear scanners in brain imaging. The first 1,000 studies performed on patients suspected of having brain pathology were reviewed. In order to assess the accuracy of autofluoroscope imaging, the studies were compared with either rectilinear scans or neuroradiologic examinations or both. Rectilinear scans and neuroradiologic examinations were chosen for the comparisons because their accuracy has been shown to be 81.5–84% and 84–93.4%, respectively (*6–8*).

MATERIAL

One thousand brain imagings were performed on the Baird-Atomic autofluoroscope. Seven hundred and forty-three of these patients had one or more additional diagnostic studies. Rectilinear scans were performed on 687 of the 743 patients, using the 3- or 5-in. Picker scanner. Two hundred and forty of the 743 patients reported here had proven diagnosis by neuroradiologic examinations. Some of these patients also had proven diagnosis by surgery. Seven of these cases were not used because there was an interval of more than two weeks between the two studies.

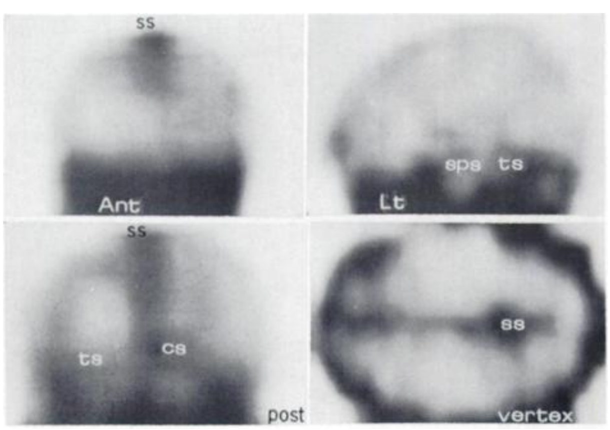

FIG. 1. Defocused normal anterior, left lateral, posterior, and vertex views. ss, sagittal sinus; sps, sphenoparietal sinus; cs, confluent sinus; ts, transverse sinus.

PROCEDURE

All patients were given 500 mg of potassium perchlorate orally 30 min before an intravenous injection of 10 mCi of $^{99m}TcO_4^-$. Routine autofluoroscope brain images including anterior, posterior, both laterals, and vertex views were obtained in all patients 30 min after injection. The average imaging time was 35 sec per view. The raw data were then stored on magnetic tape. The data from the magnetic tape can be displayed on an oscilloscope in the form of a focused (Fig. 4) or defocused (Fig. 1) image.

The "isogram mode" (Fig. 5) allows one to select any range of activity (high or low count rate) of interest and display on the cathode-ray tube only those areas that fall within the selected count range.

RESULTS

Figure 1 shows normal structures such as sagittal sinus, sphenoparietal sinus, confluent and transverse sinuses. The dark lines, seen especially on the lateral views, were felt to represent superficial vascular structures. When some of these studies were compared with the venous phase of the arteriograms, there was a suggestion that these areas roughly corresponded to the venous pattern.

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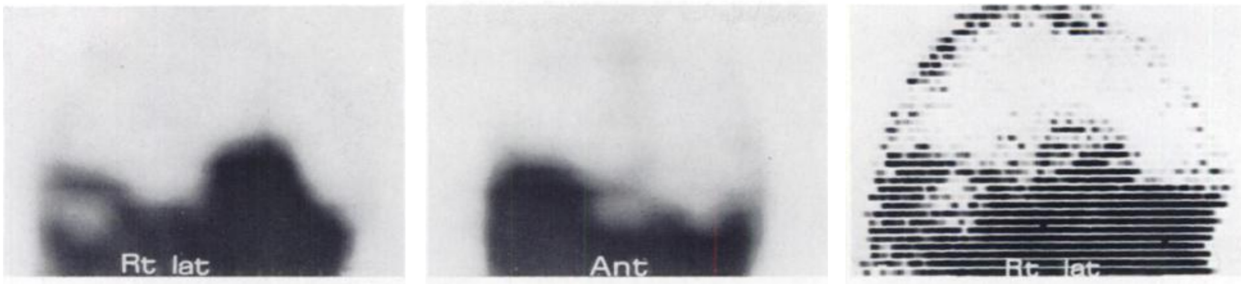

FIG. 2. Defocused right lateral, anterior, and rectilinear right lateral views. Large area of marked increased uptake in region of right sphenoid ridge on patient who had angiographically and surgically proven meningioma of sphenoid ridge.

FIG. 3. Defocused left lateral, posterior, and rectilinear left lateral views. Area of increased uptake in left posterior parietal region on patient who had cancer of lung and central nervous system symptoms.

Primary tumors (Fig. 2) and metastatic tumors (Fig. 3) are the commonest lesion in our study group (Table 1). Some of the patients with cerebrovascular occlusive disease (Fig. 4) were evaluated with static imaging as well as a dynamic cerebral blood flow study, which is easily done with the autofluoroscope.

There were one or more additional diagnostic studies available on 743 cases who had autofluoroscopic brain imaging. A comparison of the autofluoroscope and rectilinear scan in 687 of these cases showed an agreement of 89% (614 of 687) (Table 2).

Two hundred and thirty-three of the 743 cases had neuroradiologic studies. One hundred and ninety-three (82%) of these agreed with the autofluoroscope findings (Table 3). Twenty-nine (12.4%) were read as negative but were positive by neuroradiologic studies. Eleven (5.2%) were read as positive but were negative by neuroradiologic studies.

One hundred and seventy-seven of the 687 cases who had rectilinear scans had neuroradiologic stud-

TABLE 1. 233 PATIENTS HAD NEURORADIOLOGIC EXAMINATIONS

Normal	139
Tumor	73
Cerebrovascular accident	10
Subdural hematoma	4
Arteriovenous malformation	3
Abscess	3
Epidural hematoma	1

TABLE 2. 687 PATIENTS HAD RECTILINEAR SCAN

Autofluoroscope	vs	rectilinear scan
Agreed		614 (89%)
Disagreed		73 (11%)
Total		687 (100%)

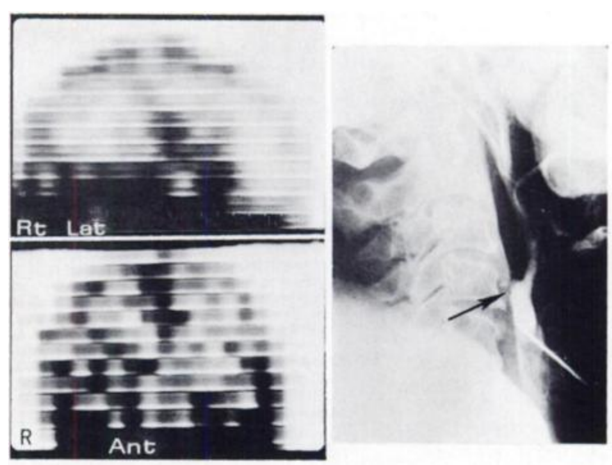

FIG. 4. Focused right lateral and anterior views. Increased uptake in distribution of right middle cerebral artery on patient who had complete occlusion of right internal carotid artery (arrow) at its origin on carotid angiogram.

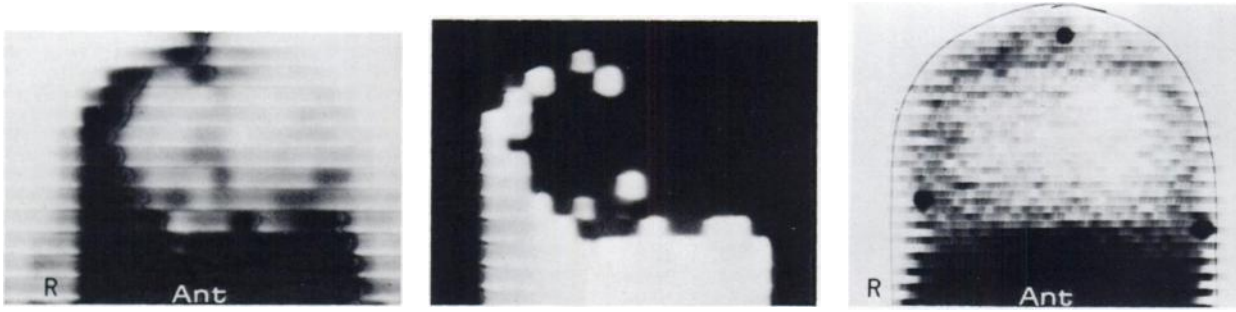

FIG. 5. Focused anterior view, "isogram" of same view as shown in previous figures and rectilinear anterior view. Increased peripheral uptake on right side was due to surgically proven chronic subdural hematoma.

TABLE 3. 233 PATIENTS HAD NEURORADIOLOGIC STUDIES

Autofluoroscope	vs neuroradiologic studies			
Normal	Normal	127	agreed	193 (82%)
Abnormal	Abnormal	65		
Normal	Abnormal	29	disagreed	40 (18%)
Abnormal	Normal	11		

TABLE 4. 177 PATIENTS HAD RECTILINEAR SCAN AND NEURORADIOLOGIC STUDIES

Rectilinear scan	vs neuroradiologic studies			
Normal	Normal	91	agreed	147 (83%)
Abnormal	Abnormal	56		
Normal	Abnormal	18	disagreed	30 (17%)
Abnormal	Normal	12		

ies. Eighty-three per cent (147 of 177) agreed with the neuroradiologic studies (Table 4). The false negative rate was 10% (18 cases) and the false positive rate was 7% (12 cases). Most of the false negative and positive results were due to lesions located in the parasellar and posterior fossa regions.

DISCUSSION

In comparison with the rectilinear scanner, the advantages of the autofluoroscope appear to be short imaging time; therefore, studies can be repeated within a few seconds. The raw data are stored on magnetic tape. Thus, subsequent data manipulations using various parameters, such as contrast enhancement, background subtraction, and isogram mode, are possible. We feel that the accuracy of the autofluoroscope is equal to the rectilinear scanner in experienced hands.

The disadvantage appears to be more "down time" than normal although this has improved greatly. The resolution of the autofluoroscope is not as good as a rectilinear scanner. There are a number of electronic artifacts in the resultant image that must be recognized. The Polaroid camera does not give a good reproduction of the oscilloscope image. Therefore, a 35-mm camera is necessary. Data retrieval can be time consuming. The instrument cannot be used by the technician while studies are being reviewed.

Among the patients who had all three studies including autofluoroscope imaging, rectilinear scan, and neuroradiologic examination, disagreements are seen in eight normals, eight parasellar lesions, three cerebrovascular accidents, two acute subdural hematoma, two cerebral metastases, one callosal glioma and one aneurysm.

SUMMARY

One thousand brain scans were performed on the autofluoroscope. Seven hundred and forty-three had additional diagnostic studies. The overall accuracy in detecting brain pathology was 82% for the autofluoroscope and 83% for the rectilinear scanner.

ACKNOWLEDGMENT

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