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The Cellular Localization of Mercury-203 Chlormerodrin in Astrocytomas

George L. Jackson, M.D.,[1] Margaret L. Corson, M.D.[2] and Jane Dick[3]

Harrisburg, Pa.

INTRODUCTION

Since the original work of Blau and Bender (1) describing the use of ^{203}Hg Chlormerodrin for the localization of brain tumors, there has been frequent discussion of the altered physiology or bio-chemistry involved in the deposition of this material in central nervous system lesions. Intimately involved with this consideration has been the related question as to the site of this deposition, that is, neoplastic cells, hemorrhagic areas, necrotic tumor, new blood vessels, etc. It is generally conceived that there are alterations in the blood brain barrier which result in an abnormal brain scan. This paper is a demonstration of the cellular deposition of ^{203}Hg Chlormerodrin in the neoplastic cells of two histologically distinct and different astrocytomas. The authors are unaware of comparable published data and feel that this demonstration is a contribution to our understanding of the mechanism of production of abnormal brain scans in this pathologic entity.

METHODS AND MATERIALS

The two patients reported herein each received 1 cc of stable mercuhydrin the night before the intravenous injection of ^{203}Hg Chlormerodrin (10 microcuries per kilogram). Both patients received 700 μC. In one patient, (R.S.), the abnormal brain scan was recorded six days before a left temporal craniotomy was performed. In the other patient, (C.C.), the abnormal brain scan was recorded one day before the left temporal craniotomy.

The tissue removed at operation was sent to the Histology division of the Department of Pathology. The tissue was then processed in the Autotechnicon and embedded in paraffin. Sections five or six microns thick were cut and prepared in xylol, absolute alcohol, and one per cent celloidin in ether-alcohol mixture.

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[1]Head, Section of Nuclear Medicine, Harrisburg Hospital, South Front Street, Harrisburg, Pa., 17107, and Ass. Prof. Medicine, Hahnemann Medical College, Philadelphia, Pa.

[2]Chief Pathology Resident, Harrisburg Hospital, South Front Street, Harrisburg, Pa., 17101.

[3]Technician, Nuclear Medicine, Harrisburg Hospital, South Front Street, Harrisburg, Pa., 17101.

The slides for radioautography were then counted for three minutes each on the face of a 3-inch diameter × 2-inch thick Na I (thallium-activated) crystal. The slides of patient C.C. did not produce a count-rate above background. R.S.'s slides, on the other hand, showed a constant increase above background (average 10%).

The slides were then coated with Kodak NTB-2 emulsion and placed in a light-tight container. The slides were developed on the 28th day. For developing we use Kodak D-19 developer and an acid fixer. The slides were then placed in a dust free area to dry for 24 hours. The slides were then stained using the following steps:

1) Harris' Haematoxylin
2) Water bath
3) Acid alcohol
4) Ammonium hydroxide
5) 95% alcohol
6) Eosin
7) 95% alcohol
8) Absolute alcohol

The slides were again placed in a dust free area to dry for approximately 24 hrs.

PATIENTS

R.S. (a 61-year-old white male) was admitted to the hospital with a one month history of mental confusion and weakness of the right leg. A skull x-ray

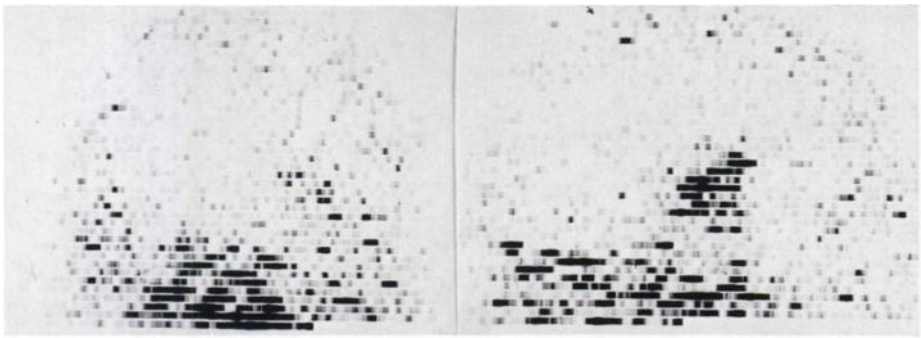


Fig. 1 (left). R.S. Anterior brain scan showing an asymmetric concentration in the left hemisphere.

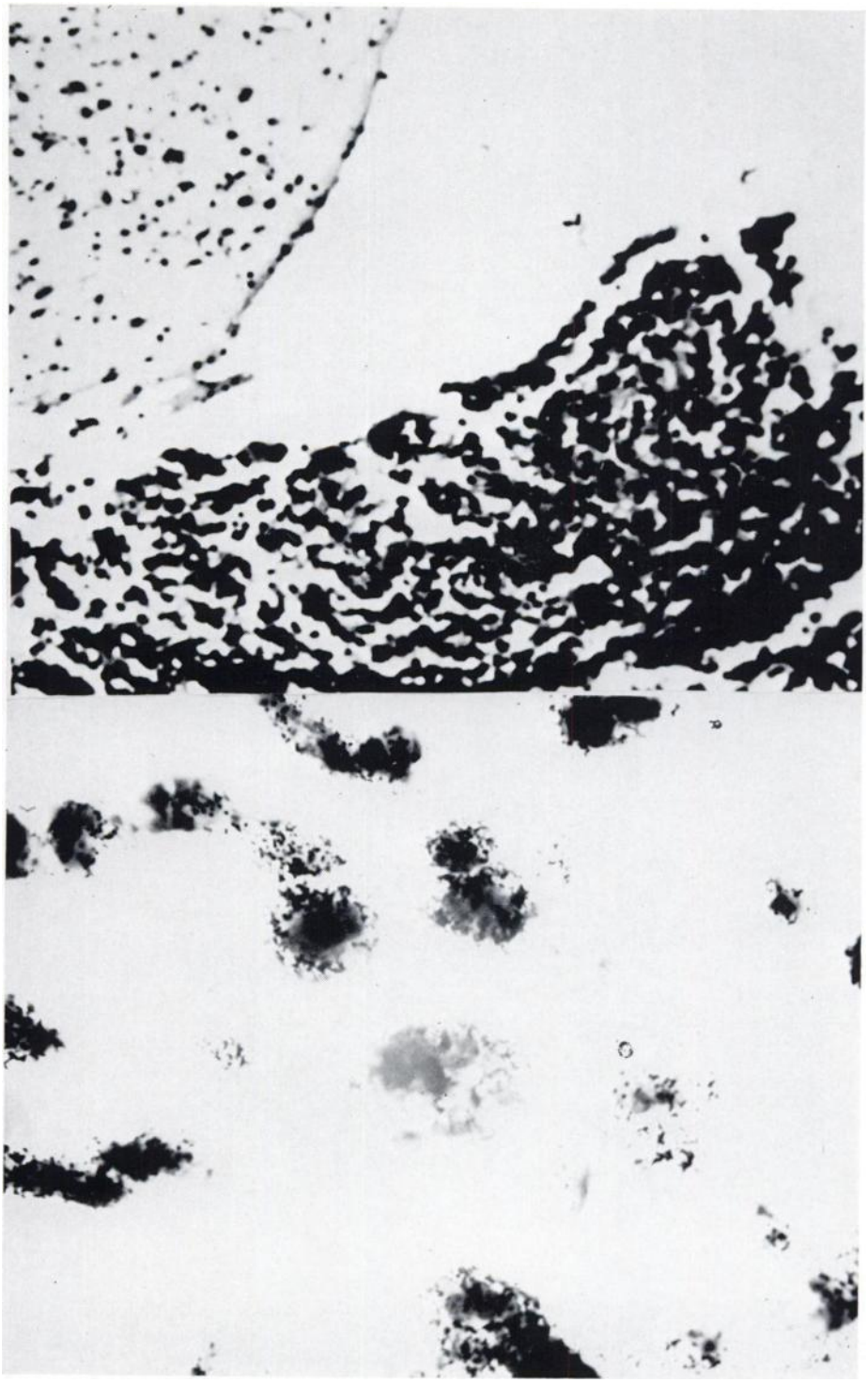
Fig. 2 (right). R.S. Left lateral brain scan revealing an abnormal concentration in the temporal lobe area.

Fig. 3 (top). Pt. R.S. diagnosis: Astrocytoma, Grade IV, (predominantly gemistocytic) high power (100× magnification)

In the left upper quadrant of the Figure, one can see the normal brain tissue. The lower portion of the figure represents the tumor. The tumor appears considerably darker due to the exposed photographic emulsion overlying.

Fig. 4 (bottom). Pt. R.S. diagnosis: Astrocytoma, Grade IV, (predominantly gemistocytic) high power, oil (1000× magnification)

Individual malignant cells demonstrating also the clustering of exposed photographic emulsion overlying the cell with nearly no exposed emulsion in the space between the cells.



Legends for Figs. 3 and 4 appear on preceding page.

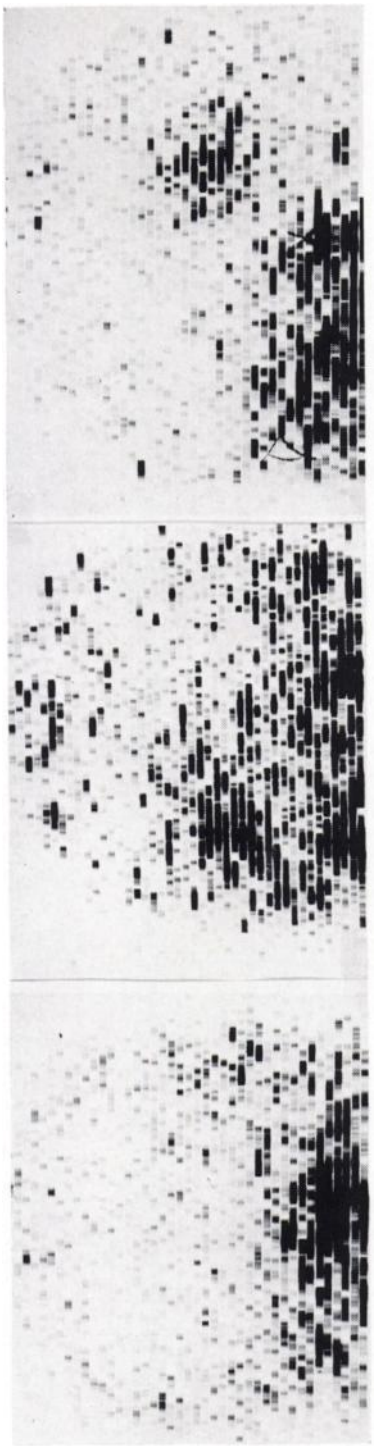


Fig. 5 (left). C.C. Anterior brain scan with suggestion of asymmetry in the left hemisphere.

Fig. 6 (center). C.C. Posterior brain scan revealing definite asymmetry with an abnormal deposition of Radioactivity in the left hemisphere.

Fig. 7 (right). C.C. Left lateral brain scan showing a definite abnormal concentration in the region of the parieto-occipital lobe area.

revealed a prominent vascular pattern in the posterior aspect of the parietal bone which was thought to be an anatomic variant. A left cerebral arteriogram (done after the brain scan) demonstrated a space-occupying lesion in the mid-temporal region characterized by new vasculature. The pathologic diagnosis of tissue removed at the time of a left temporal craniotomy was reported as astrocytoma, Grade IV, (predominantly gemistocytic).

The second patient C.C. (a 64-year-old white male) was admitted with a five-day history of mental confusion. A skull x-ray was reported as negative. The pathologic diagnosis of tissue at the time of a left temporal craniotomy was reported as astrocytoma, Grade IV, (glioblastoma multiforme).

RESULTS

The abnormal brain scan of patient R.S. is shown in figures one and two. The radioautographs prepared as noted previously revealed the deposition of Radioactive Mercury within the neoplastic cells. Figure three clearly demonstrates the unequal deposition of ^{203}Hg as evidenced by the difference in exposed photographic emulsion. Figure four illustrates that the ^{203}Hg has an affinity for the neoplastic cell.

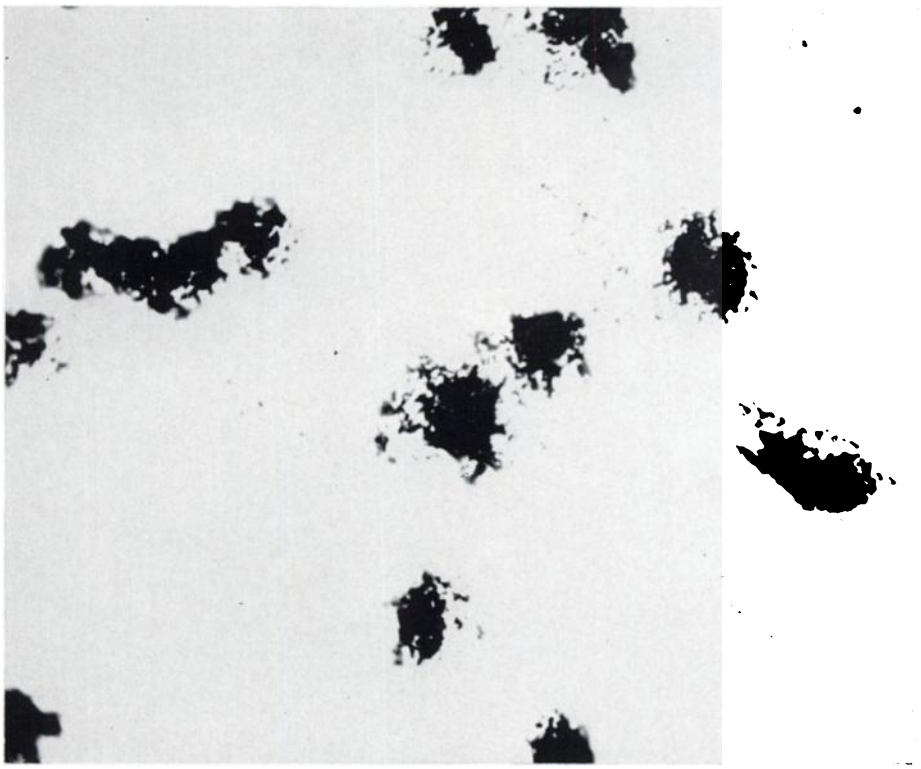


Fig. 8. Pt. C.C. diagnosis: Astrocytoma, Grade IV, (glioblastoma multiforme), high power (1000× magnification).

Showing individual neoplastic cells with a concentration of exposed emulsion overlying.

The second patient, C.C., had an abnormal brain scan as demonstrated in figures 5, 6, and seven. The radioautograph is shown in figure eight. This also demonstrates the deposition of Radioactive Mercury in the region of the neoplastic cells.

COMMENTS

The radioautographs illustrated in this paper have been reviewed by several pathologists and other persons interested in the general problem presented. It is the opinion of all concerned that these illustrations show that in these two patients with histologically distinct and different astrocytomas the deposition of Radioactive Mercury (as Chlormerodrin) is on or within the neoplastic cell.

SUMMARY

This paper has demonstrated by radioautographic procedures that in two patients with histologically different astrocytomas, Radioactive Mercury (as Chlormerodrin) has been deposited on or within the neoplastic cells.

ACKNOWLEDGEMENTS

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REFERENCE

1. Blau, M. and Bender, M. A., Clinical Evaluation of 203-Hg Neohydrin and 131-I Albumin in Brain Tumor Localization, *Journal of Nuclear Medicine,* 1:106, April, 1960.