The Use of Echoencephalography to Differentiate Intracerebral Hemorrhage and Brain Softening

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ULTRASOUND wave was first used in the diagnosis of intracranial disease by Dussik in 1942 when he applied an ultrasonic transmission method. In recent years a reflection method has been used with excellent results. Ultrasonic diagnosis of intracranial disease is based on the observation of the shift of the midline echo, which corresponds with the reflected echo of the midline structure, as well as on the observation of the reflected echo derived from the intracranial lesion itself.

We have found in our surgical treatment of hypertensive intracerebral hemorrhage that it has often been difficult to differentiate intracerebral hemorrhage from cerebral softening. In intracerebral hemorrhage the echogram shows a midline echo shift whereas in cerebral softening there is none. We have found, however, that when the hematoma is small enough not to produce a midline echo shift, the hematoma echo with its multiple spike-like pattern derived from hematoma itself is a better diagnostic guide. We are now reporting our experiences with echoencephalography in the differential diagnosis of intracerebral hemorrhage, cerebral softening, and subarachnoid hemorrhage.

Method

An Aloka SSD-2 apparatus (Japan Radio Company Ltd., Tokyo) of the reflection type was used, with barium titanate 10 mm in diameter as the transducer. The best frequency for registering the hematoma echo appeared to be 2.25 mc. The transducer was placed over the temporal scalp, and records were made from the normal side as well as that of the lesion.

During operation a special transducer was placed over the dura to determine by echo pattern the depth, location, and extent of the hematoma from the cortex. This was done through the same 4 cm frontal or temporal trephine opening used to evacuate the hematoma. Postoperative examination, done the same way as the preoperative study, registered the echo pattern and change in the midline echo shift following removal of the hematoma.

Cases with Hypertensive Intracerebral Hemorrhage

Only those patients in whom the size and location of the hematoma were confirmed by surgery or autopsy were included in this study. There were 61 patients ranging in age from 38 to 75 years; 43 were men and 18 women, 52 with supratentorial hemorrhages and 9 with infratentorial hemorrhages. The earliest case was examined 6 hours after the attack, with 55 cases being examined within 7 days.

Supratentorial Hemorrhage. 1. Preoperative scalp echoencephalogram. Of 52 cases with supratentorial hemorrhage, 49 (94%) showed a hematoma echo with a multiple spike-like pattern. Midline echo shift (Fig. 1) was positive in 43 patients (83%) and negative in 9 (17%). There were no false positive cases. Of

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nine cases with no midline shift, three were false negative.

2. Preoperative dural echoencephalogram. Epidural examinations were done in 28 cases. In all of these cases the hematoma echo was sharper than that in the scalp recording (Fig. 2). The distance between the dura and the hematoma determined from the hematoma echo and actual exploration was compared in 20 cases; the error was less than 5 mm in 11 cases (55%) and within 6 to 10 mm in three cases (15%). No error more than 11 mm was recorded.

3. Postoperative scalp echoencephalogram. Postoperative echogram was recorded in a similar manner as the preoperative examination, over the temporal scalp. In 21 cases, changes in the midline echo shift and hematoma echo were followed periodically 3); the midline echo shift was reduced on the first postoperative day, improved appreciably within 3 days, and returned to normal within several days. The hematoma echo was somewhat reduced on the first day and was more simplified in pattern up to 7 days; the interval of the echo was also decreased. Within 2 to 3 weeks the hematoma echo disappeared and became a single spike, which persisted afterwards in some cases.

Infratentorial Hemorrhage. Seven of nine cases in this group had pontine hemorrhage with rupture into the fourth ventricle, one had a pontine hemorrhage with bleeding into the cerebellum, and one had a cerebellar hemorrhage. A midline echo shift was noticed in only one case and was negative in the remaining eight. A hematoma echo was noticed in three and not in the remaining six.

Cases with Brain Softening

A total of 35 cases comprising 23 men and 12 women aged 43 to 78 years was examined. Seven cases were in an acute and 28 in a chronic stage. They were diagnosed as having