Coronal computerized angiotomography for the diagnosis of isodense chronic subdural hematoma

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The authors demonstrate the value of coronal computerized angiotomography for the diagnosis and screening for isodense chronic subdural hematoma. Specific features of coronal computerized angiotomograms include 1) thick lines of high density with slight convexity; 2) lines of high density parallel with the inner table of the skull; or 3) high-density dotted lines away from the inner table. These high-density lines or dots represent the superficial cerebral veins and cortical branches of the middle cerebral artery, which have been displaced by the hematoma. When these characteristic features are revealed on noninvasive coronal computerized angiotomography, cerebral angiography may be unnecessary.

KEY WORDS · chronic subdural hematoma · isodense lesion · computerized angiotomography · coronal scanning · bolus injection method

There is no doubt that computerized tomography (CT) is a very useful method for detecting chronic subdural hematoma (SDH); however, isodense chronic SDH has been difficult to detect by CT because its density is equal to that of brain. As our experience has proven coronal computerized angiotomography to be very useful in the diagnosis of this condition, we wish to present its specific features.

Clinical Material and Methods
This study comprised seven patients with chronic SDH in whom precontrast CT scans demonstrated isodensity. These patients were among 51 patients with chronic SDH seen during the 32-month period between January, 1980, and August, 1983, at the Department of Neurological Surgery, Matsuyama Shimin Hospital. Three of these seven patients showed secondary changes on the precontrast CT images, such as shift of the ventricles or compression or obliteration of the Sylvian fissures and cortical sulci. The remaining four were without these CT findings.

Coronal computerized angiotomography was performed as follows: The patient was placed supine with the head extended, and the gantry was angled at approximately 60° to the canthomeatal line. We used the intravenous "minimum dose bolus" method to administer contrast material. We have previously described the use of this method to demonstrate the cerebral vessels clearly on CT images. This technique consists of injecting 1 ml/kg of 60% methylglucamine iothalamate with a No. 18 needle via the basilic vein at the rate of 2 ml/sec; the scan is begun immediately thereafter. Usually, it was sufficient to make serial scans at 10-mm intervals, centered around the anterior clinoid processes. Contrast materials may be injected once more as in the first scan if the cuts are not suitable. We used a GE CT/T8800 scanner with a 320 x 320 matrix, with a 10-mm slice thickness and 9.6-sec scanning time.

Results
Seven patients in whom chronic SDH could not be detected by the precontrast CT scan due to its isodensity with brain were clearly and accurately diagnosed on the postcontrast coronal computerized angiotomography. The following features were diagnostic: 1) a thick, slightly convex line of high density (Fig. 1); a line of high density parallel with the inner table of the skull (Fig. 2); or 3) a row of high-density dots separate from the inner table (Fig. 3). The high-density lines or dots represented the superficial cerebral veins or cortical...
FIG. 1. Studies in a 68-year-old man who had been struck by an automobile 2 months previously.  

- a: The precontrast coronal scan shows a thin lesion of slightly increased density in the left parietal region.
- b and c: Coronal computerized angiotomograms showing both of the superficial cerebral veins displaced away from the inner table of the skull as thick high-density lines with slight medial convexity (arrows).
- d and e: Bilateral carotid angiograms, anteroposterior view in the venous phase, showing thin bilateral chronic subdural hematoma.

FIG. 2. Studies in a 48-year-old woman who had struck the frontal region of her head 1 month earlier.  

- a: No definite subdural hematoma (SDH) is shown in the precontrast coronal image.
- b: Coronal computerized angiotomogram showing a high-density line (arrows) running in the right parietal region at a slight distance and parallel with the inner table of the skull. An isodense zone lies between them.
- c: Right carotid angiogram, anteroposterior view in the venous phase, showing a thin chronic SDH.
CT scanning in chronic subdural hematoma

Fig. 3. Studies in a 48-year-old man who was hospitalized because of headache following a fall 3 months previously. a: Precontrast coronal scan shows a marked midline shift from right to left and obliteration of the cerebral sulci and Sylvian fissure on the right side. b: Coronal computerized angiotomogram demonstrates high-density dots (arrows) over the right hemisphere. The isodense zone lies between the high-density dots and the inner table of the skull. c: Right carotid angiogram, anteroposterior view in the arterial phase, showing a large chronic subdural hematoma.

branches of the middle cerebral artery, which were displaced by the hematoma.

Discussion

Chronic SDH is classified into four different degrees of density on CT images: high, low, mixed, and isodense. Computerized tomography has become a major diagnostic tool in the evaluation of chronic SDH, but the CT diagnosis of the isodense variety has been difficult and often gives false-negative results because of its isodensity with brain. The existence of the hematoma may be suggested by indirect CT findings, such as ventricular deformity, obliteration and displacement of the cortical sulci, cisterns, and Sylvian fissures, and shift of the midline structures, none of which are specific to this condition. In thin or bilateral isodense chronic SDH especially, diagnosis by CT is even more difficult.

We attempted to solve two main problems in the diagnosis of isodense chronic SDH on a CT image: 1) to find a suitable scan projection to demonstrate the high convexity region in which chronic SDH usually presents; and 2) to provide direct and clear demonstration of the superficial cerebral veins and cortical branches of the middle cerebral artery, which are displaced by the hematoma.

Chronic SDH usually presents in the parietal convexity. The coronal plane is directly perpendicular to the hematoma in this region and grossly parallel to the superficial cerebral veins and cortical branches of the middle cerebral artery. Therefore, this plane permits better visualization of the high convexity lesion and blood vessels affected by the hematoma than does the standard axial transverse plane. The 60° modified coronal projection plane does not cause pain or discomfort to the patient and avoids the interference of artifacts from metallic artificial teeth.

If contrast material is used, the blood vessels displaced away from the inner table of the skull may occasionally be visualized on CT. But the diagnostic value of the conventional contrast-enhanced CT is not great because the iodine blood level in the carotid artery does not exceed 15 mg/ml, the amount necessary to obtain a clear image of the cerebral vessels. The intravenous “minimum dose bolus” method, which we used in this series, permits us to obtain much clearer vascular images due to high iodine blood levels of more than 15 mg/ml. With this means of enhancement, superficial cerebral veins and cortical branches of the middle cerebral artery can be clearly demonstrated as high-density lines or dots separated from the inner table of the skull. When these characteristic computerized angiotomographic findings are obtained, angiography may be unnecessary for diagnosis. In cases of bilateral hematomas, computerized angiotomography does not neglect one side because it can demonstrate bilateral blood vessels simultaneously (Fig. 1b and c).

Large isodense chronic SDH with midline shift must be differentiated from brain tumor, edema, and infarction, and it has been said that angiography is necessary for this purpose. But, as shown in Fig. 3b, computerized angiotomography provides an easy and noninva-
sive method to differentiate chronic SDH from other conditions.

References


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