Caudothalamic Groove: Value in Identification of Germinal Matrix Hemorrhage by Sonography In Preterm Neonates

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Caudothalamic Groove:
Value in Identification of Germinal Matrix Hemorrhage by Sonography in Preterm Neonates

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A prospective study of 25 consecutive premature infants under 1,500 g was undertaken to evaluate the frequency and sonographic appearance of subependymal germinal matrix hemorrhage. In all 12 sonographically positive cases, the hemorrhage was initially imaged in the area immediately anterior to the caudothalamic groove. Special attention to this area permits early detection of germinal matrix hemorrhage, and neurosonography of neonates should be considered incomplete unless this area has been thoroughly imaged.

Sonography has been recommended as the primary technique for detecting intracranial hemorrhage in preterm neonates [1–4]. This technique is both sensitive and specific for subependymal germinal matrix hemorrhage, intraventricular hemorrhage, and ventriculomegaly [1–3]. Satisfactory studies can be performed at the bedside with little risk to the infant. Since neonatal neurosonography is often performed under less than ideal conditions, it is important that the examiner recognize when an adequate study has been accomplished. Several authors have suggested arbitrary and fixed routines [4–6]. In a prospective study of 25 consecutive premature infants under 1,500 g, we noted that one specific view showing the caudothalamic groove is critical for the detection of subependymal germinal matrix hemorrhage. It is essential that the sonographer performing these studies be familiar with this view and with the technique, normal anatomy, and pathologic anatomy of the caudothalamic groove.

Materials and Methods

The purpose of this study was to examine intracranial structures of 25 consecutive premature newborn infants weighing less than 1,500 g by sonography. Each infant was studied shortly after birth and then daily for 10 days. The sequential appearance, natural history, and optimal sonographic technique for imaging subependymal germinal matrix hemorrhage were analyzed. Informed consent for sonography was obtained from a parent. A total of 29 patients was studied; four of these were excluded from the study because of death before 10 days of age or transfer to another facility. Examinations were performed with sector real-time units (Advanced Technology Labs., Bellevue, WA) using 5 MHz medium-focus transducers. Our routine consists of five sagittal sonograms and five coronal sonograms through the anterior fontanelle. Special care is taken to image the region of the caudothalamic groove (fig. 1). Germinal matrix hemorrhage was diagnosed using suggested criteria outlined in the literature [1–6]. For certainty about small subtle hemorrhages we also required confirmation by demonstration of increasing or decreasing hemorrhage in sequential sonograms associated with minor alterations in contour of the ipsilateral ventricle.

Computed tomographic scans were obtained in six of the 25 subjects. In every case the sonographic findings were confirmed. Four of these patients had subependymal germinal matrix hemorrhage and two were without evidence of hemorrhage.

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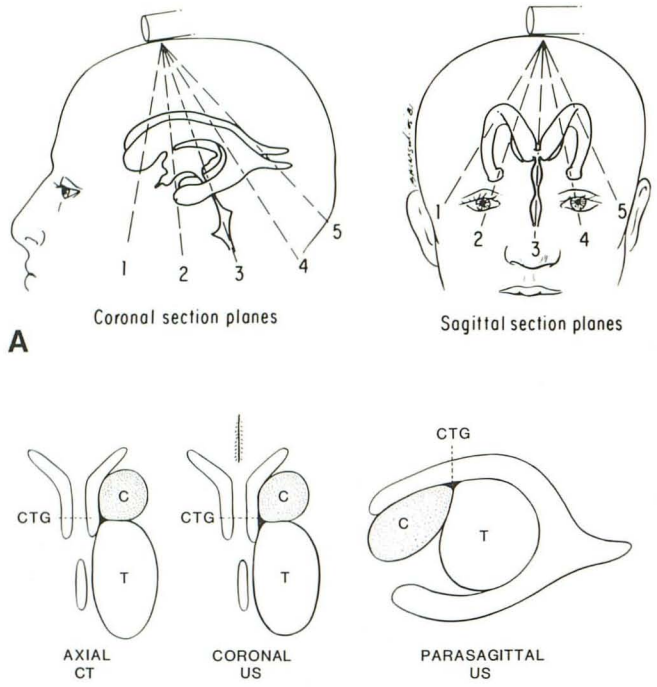

Fig. 1.—**A**, Routine neurosonographic sections. Caudothalamic groove is best imaged with parasagittal sections 2 and 4. **B**, Early subependymal germinal matrix hemorrhage in region of caudothalamic groove as imaged by axial computed tomography, coronal sonography, and parasagittal sonography.

Results

Twelve of 25 patients studied showed germinal matrix hemorrhage by these criteria while 13 did not. There was bilateral involvement in four patients. Four patients with germinal matrix hemorrhage that extended anterior to the caudothalamic groove or intraparenchymally developed significant ventriculomegaly within the 10 day study period.

There was a total of 16 germinal matrix hemorrhages in 12 patients. In 14 of these hemorrhages, the earliest recognizable abnormality was a small area of increased echogenicity adjacent to and anterior to the caudothalamic groove. This was best recognized on parasagittal sections near the medial aspect of the head of the caudate nucleus (fig. 2). In the two other patients, both this area and the adjacent brain parenchyma were the first sites of intracranial hemorrhage to be seen. Thus, all of the 16 hemorrhages we recognized initially involved the area just anterior to the caudothalamic groove. Looking at this specific anatomic site, we were able to detect 15 of the 16 hemorrhages within the first 2 days after birth. The other small germinal matrix hemorrhage was detected on day 5.

Discussion

It is hypothesized that germinal matrix hemorrhage originates within the subependyma at the level of the head of the caudate nucleus in most preterm infants [7]. In those of less

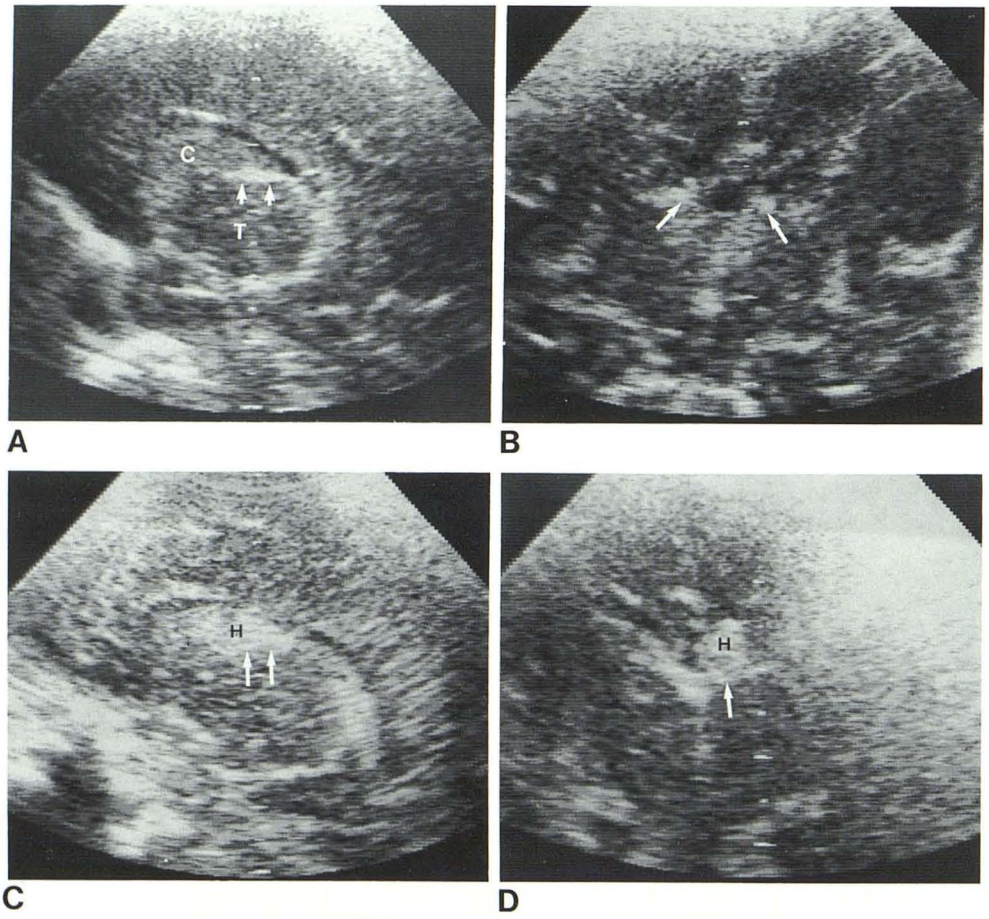

Fig. 2.—**A**, Sagittal view. Caudothalamic groove (*arrows*) separates caudate nucleus (C) from thalamus (T) in normal preterm infant. **B**, Coronal view of the caudothalamic groove (*arrows*) showing slightly more echogenic groove on right than on left in normal preterm infant. **C**, Sagittal view of early germinal matrix hemorrhage (H) lying in front of caudothalamic groove (*arrows*) and partly obliterating it. **D**, Coronal view showing left germinal matrix hemorrhage (H) adjacent to caudothalamic groove (*arrow*).

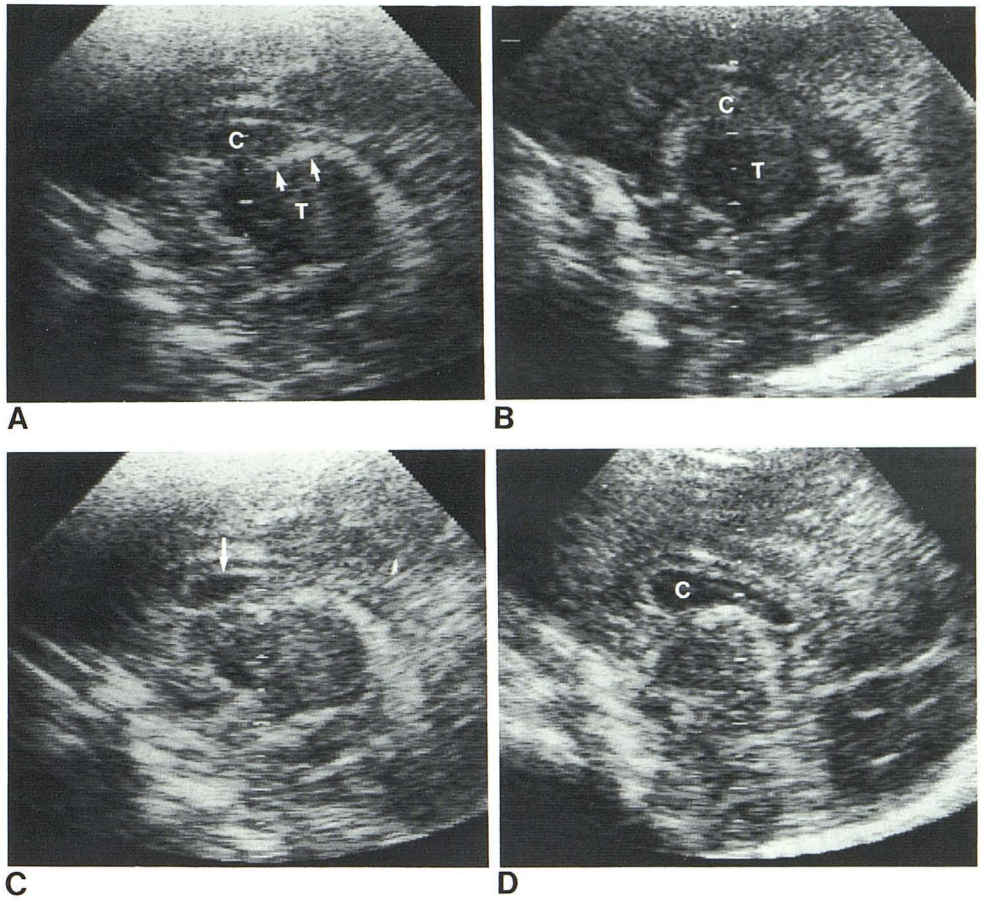

Fig. 3.—**A**, Caudothalamic groove (*arrows*) on sagittal section in optimal scan plane. C = caudate nucleus; T = thalamus. **B**, Sagittal scan plane just lateral to that in **A** shows caudate nucleus (C) and thalamus (T). This plane should be examined but may be too lateral to see a very small germinal matrix hemorrhage. **C**, Sagittal scan plane medial to **A**. Apparent increased thickness of caudothalamic groove can be confused with early hemorrhage. This inappropriate plane can be recognized by presence of cavum septum pellucidum (*arrow*). **D**, Even more medial scan plane can produce misleading appearance. C = cavum septum pellucidum.

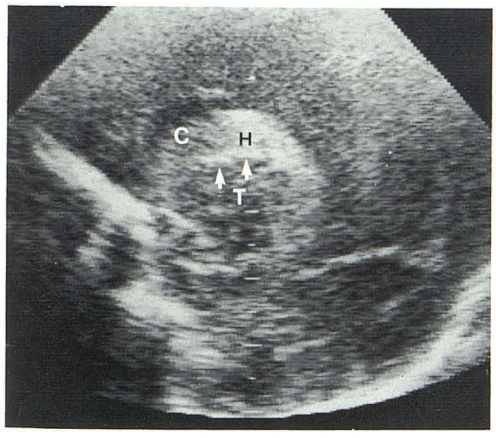

Fig. 4.—Sagittal view showing typical early germinal matrix hemorrhage (H) in front of caudothalamic groove (*arrows*). This should be compared with misleading examples in fig. 3. C = caudate nucleus, T = thalamus.

than 28 weeks' gestation, the hemorrhage may occur at the level of the body of the caudate nucleus; hemorrhage in the term infant may originate in the choroid plexus [8]. Our observations confirm that germinal matrix hemorrhage occurs most frequently near the head of the caudate nucleus. There may be difficulty in distinguishing slight asymmetry of the choroid plexus from small hemorrhages. This is a frequent problem on coronal sections in which there is asymmetry of echogenicity in the paraventricular, subependymal region. This misleading appearance, which may be confused with germinal matrix hemorrhage, is due to asymmetry of the choroid plexus or angulation from the coronal plane.

The choroid plexus courses from the floor of the lateral ventricles to the roof of the third ventricle through the foramina of Monro; the caudothalamic groove is lateral and extends anterior to the foramina of Monro (fig. 1B). Increased echogenicity anterior to the caudothalamic groove cannot be due to normal choroid plexus. Identification of this landmark thus permits identification of very small, early germinal matrix hemorrhages (fig. 1B). Care must be taken in obtaining a sagittal view of this area (fig. 1A). If the head of the caudate nucleus is not included and the scan plane is oblique then strong echoes from the margin of the lateral ventricle may simulate a small hemorrhage (fig. 3). But if the scan plane is correctly aligned so that the most medial plane that fully demonstrates the head of the caudate nucleus, the thalamus, and the thin groove between them is shown, then virtually every small subependymal germinal matrix hemorrhage can be correctly identified (fig. 4).

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