

# Posterior Fossa Subdural Hematomas in Neonates

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• **Posterior fossa subdural hematomas in the newborn infant are rare but potentially treatable. The infants are normal after birth, but within days, hydrocephalus hypotonia, and irregular respirations develop. Seizures and third nerve pareses are unusual. We report a neonate in whom this process was identified by computerized tomographic brain scan. We also discuss potential misinterpretations of the computerized tomographic brain scan in neonates.**

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Posterior fossa subdural hematomas in newborn infants are less frequent than those located supratentorially in autopsy series.<sup>1</sup> Eight cases of clinically identified infratentorial subdural hematomas have been described in the literature. Unfortunately, neurologic consultants do not always consider this rare but potentially treatable entity.<sup>2-7</sup> We report a newborn infant with a computerized tomographic (CT) brain scan of a posterior fossa subdural hematoma.

This case also emphasizes a potential pitfall in interpretation of germinal matrix hemorrhages in neonates with CT scans and stresses the need for continuous pathologic correlations.

## REPORT OF A CASE

This 3.2 kg male full-term infant was born of an uncomplicated (gravida 3, para 0, abortus 2) pregnancy. The uneventful ten-hour labor was followed by a vaginal vertex delivery without the aid of forceps. The Apgar scores were 9 at one and five minutes, and head molding and facial ecchymosis were absent. On the fourth day, the child was noted to be jaundiced, lethargic, and irritable, with a weak cry, irregular shallow respirations, and a pulse of 100 beats per minute. Subsequently, respiratory arrest occurred. Rapid resuscitation was successful, though he required intubation and assisted ventilation. After arrest, the pupils were fixed and dilated and opisthotonic posturing occurred. The hematocrit value was 31%, WBC count was 24,400 cu mm, blood cultures were negative, coagulation studies were normal, and the serum electrolyte level and blood chemistry studies were normal, except for an elevated direct bilirubin level. The lumbar puncture showed bloody CSF. The next day, opisthotonic posturing, irregular respirations, and tense fontanelle continued. The discs were flat, the retinae were free of hemorrhage, and the pupils were equal and reactive. The eyes were deviated to the left, with the left eye skewed slightly upward and did not pass the midline on doll's head maneuver. There was marked generalized hypotonia, but the child moved all extremities. The Moro and suck reflexes were absent, the tendon reflexes were hypoactive, and the

plantar responses were extensor. On the sixth day, the CT scan showed a large collection of blood within the posterior fossa as well as dilation of the frontal, temporal, and occipital portions of the lateral ventricles. Blood was also described in the region of both caudate nuclei (Fig 1 and 2). The infant died the following day.

The general autopsy was unremarkable except for diffuse and acute pulmonary hemorrhage. At the time of brain removal, a large collection of blood was found within the subdural space infratentorially. A small amount of subarachnoid hemorrhage accumulated adjacent to the exits of the lateral recesses and over the convexities. There were small pools of blood within the falx and tentorium. An incomplete tear of the inferior leaflet of the left tentorium extended 1 cm posteriorly from the free edge. Tears were not present within the lateral or straight sinuses, falx, or great vein of Galen. The superior aspect of the cerebellum was compressed and indented, and the lateral hemispheres displaced anteriorly toward the clivus (Fig 3). The ventral pons and upper medulla were compressed anteriorly and medially against the clivus, and the upper fourth ventricle was obstructed by displaced vermal portions of the cerebellum. The cerebrum, which was coronally sectioned after fixation, contained a small collection of blood within the right occipital horn. The few remnants of choroid plexus available for study did not disclose the site of hemorrhage. The caudate nuclei and the adjacent subependymal region were not hemorrhagic, contrary to the interpretation of the CT scan. The frontal, occipital, and temporal portions of the lateral ventricles were moderately enlarged and the superior angles were blunted (Fig 4).

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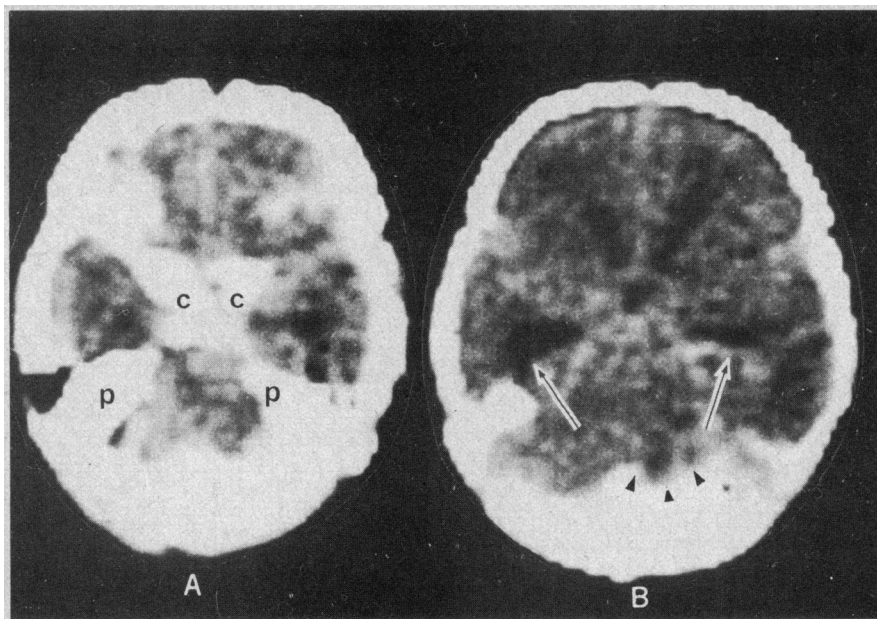


Fig 1.—Computerized tomographic scan in axial projection. A and B are adjacent representations of 13-mm thickness, with 1 mm of overlapping. A is anatomically inferior to B and right-sided structures are on right. On A, anterior clinoids (c) and petrous bones (p) are identified. Dorsum sellae are just posterior to anterior clinoids. On B, there is asymmetrical forward displacement of cerebellum (arrow heads) by intracranial substance, with density readings consistent with clotted blood. Fourth ventricle is not detectable. Dilated temporal horns and anterior horns of lateral ventricles are present (arrows).

On microscopic examination, the compressed portions of the cerebellum contained eosinophilic Purkinje cells and karyorrhectic internal granule cells. The cerebellar deep white matter was gliotic and contained acutely swollen axons. The basis pontis adjacent to the clivus was also locally injured. In this region, neurons were necrotic, and the descending and crossing fiber bundles contained hypertrophic astrocytes and markedly swollen axons. Hypertrophic astrocytes, without necrosis or hemorrhage, were present in the deep cerebral white matter. The cortex, subcortical gray matter, and cord were otherwise normal. The caudate nuclei and the subependymal region were not hemorrhagic, and the germinal matrix was normally depleted.

#### COMMENT

Posterior fossa subdural hematoma in the newborn infant is a relatively rare event but must be considered in all infants who display progressive signs of neurologic dysfunction. The child in this report, unfortunately, died prior to surgical intervention, though the CT scan of the head was consistent with this diagnosis. The site of bleeding was a rent in the

inferior leaflet of the tentorium cerebelli. The blood accumulated within the subdural space of the posterior fossa, compressed the cerebellum, obstructed the fourth ventricle, and displaced the brain stem anteriorly and ventrally against the clivus. Microscopic evidence of severe and acute injury to these regions agrees with the clinical events noted in the infant. The drop in the hematocrit value, from 47% to 31%, and the elevation of serum bilirubin level presumably reflect the intracranial hemorrhage. The diffuse pulmonary hemorrhage commonly found in neonatal autopsy series as a terminal event, has been associated with intracranial hypertension.<sup>7</sup> Craig<sup>1</sup> reported that six of ten neonates with subdural hemorrhages who died within 36 hours of birth also had pulmonary hemorrhages.

Only eight newborn term infants have been described with clinically identified infratentorial subdural hemorrhages and five survived after surgical treatment. The clinical findings in these eight cases are compared

with the present case in the Table. All of the neonates were full-term infants, the smallest weighing 3,200 gm. Information with respect to difficult labor or delivery was not always available. A lag period from half a day to four days between birth and the onset of neurologic signs was characteristic and is of clinical significance in differentiating small continuing hemorrhagic leaks that accumulate infratentorially from sudden massive hemorrhages secondary to dural sinus lacerations, avulsions of the vein of Galen, or hematomas, with rupture into the subdural space. The massive hemorrhages are associated with rapid and progressive neurologic dysfunction that usually occur immediately after birth. Several of the cases with intracerebellar hematomas and rupture into the subdural space have been salvaged with rapid surgical decompression.<sup>9,10</sup> The development of hydrocephalus, which is heralded by tense anterior fontanelle and increasing head circumference, is universally found in these infants and is usually the sign that instigates further neurological evaluation. The hydrocephalus, at least initially, is related to the cerebellar compression of the fourth ventricle and/or the outlets of the fourth ventricle. Several of the patients who were successfully treated subsequently displayed communicating hydrocephalus and required ventricular shunts.<sup>4-6</sup> The diagnosis of intraventricular hemorrhage is made in many of these infants, based on bloody ventricular and lumbar CSF, but the source of this minor ventricular hemorrhage is often not apparent. These children display early, nonspecific signs of impending neurologic collapse such as weak cry, lethargy, irritability, vomiting, and loss of Moro and suck reflexes, which are usually followed by signs referable to the posterior fossa, abnormal respirations, and hypotonia. Skew deviation, nystagmus, and sixth nerve pareses are the only major cranial nerve deficits and signs of focality that occasionally occur in this group. It is important to note the absence of third nerve paresis in these infants, a finding that is common in supratentorial masses such as subdural hemato-

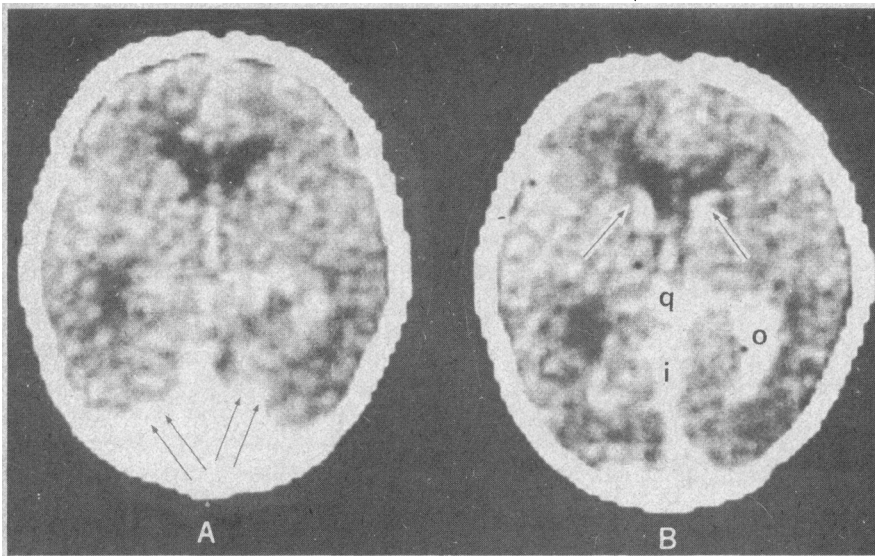


Fig 2.—Computerized tomographic scan axial projection, through brain directly above position of Fig 1, with A anatomically below B. A is at level of tentorial attachment posteriorly, and clotted blood density is seen in close relationship to tentorium between posterior aspect of two hemispheres (paired arrows). Lateral ventricles are mildly dilated. On B, clotted blood density is seen in right occipital horn (o). Same densities were found in interhemispheric fissure (i) and over quadrigeminal plate cistern (q). Blood clot was interpreted to be present just lateral to anterior horns in caudate nuclei (single arrows) as well. Last observation was erroneous (see text).

Birth weight, gm
Delivery
Onset of symptom
Tense fontanelle
Increase in head circumference
Ventricular dilation
Abnormal respiration
Lethargy, irritability
Loss of Moro's reflex
Loss of suck reflex
Abnormal tone
Vomiting
Abnormal cry
Seizures
CSF
Abnormal pupil reaction
Other deficits
Surgical therapy
Results
Communicating hydrocephalus

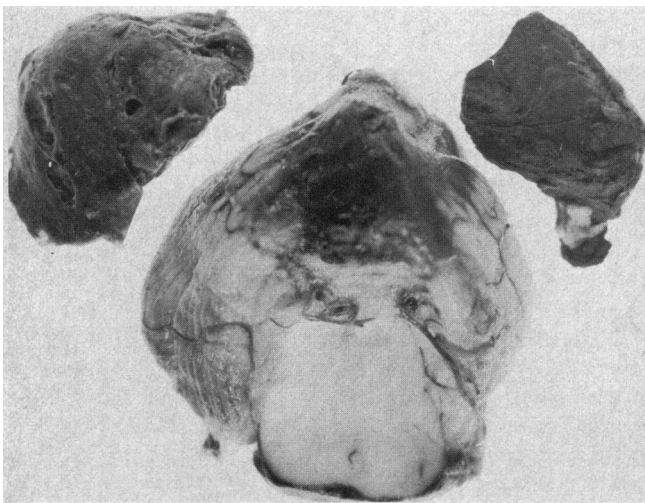


Fig 3.—Bilaterally, there are concave depressions of superior aspect of cerebellum by hematomas. Ventral aspect of pons is flattened, and rostral fourth ventricle is collapsed.

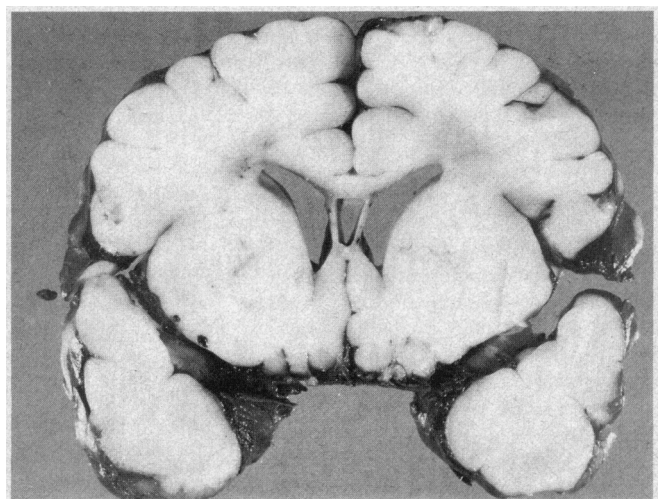


Fig 4.—Lateral ventricles are enlarged, with rounded lateral angles. Diffuse subarachnoid hemorrhage is present. There is no subependymal hemorrhage over caudate.

mas. Seizures are not commonly present.

Most of the evidence points to head molding at the time of birth as the essential factor in the production of posterior fossa subdural hematomas.<sup>1,11,12</sup> The massive hemorrhages that cause severe neurologic complica-

tions at birth or shortly thereafter are usually related to tears of the falx or tentorium cerebelli, with extension into the adjacent lateral or straight sinuses. Avulsion of the vein of Galen will also produce rapid death. In contrast, the slow accumulation of blood in the infratentorial region

arises from small tears in the tentorial leaflets or from torn bridging veins that arise from the superior surfaces of the cerebellum.<sup>1,12</sup> These lacerations and avulsions presumably result from stress on the head during delivery.

The CT scan is useful in identifying posterior fossa subdural hematomas.

Clinical Findings in Patients

Cases								
Coblentz <sup>2</sup>	Reigh & Nelson <sup>3</sup>	Pytlyk et al <sup>4</sup>	Nelson <sup>5</sup>	Carter & Pittman <sup>6</sup>	Gilles & Shillito <sup>7</sup>			Present Case
3,711	3,859	3,940	3,732	3,236	Case 1	Case 2	Case 3	3,200
Occipital caput; low forceps	Breech; easy delivery	Vertex; forceps	Vertex; forceps; easy delivery	Vertex; outlet forceps	Vertex; low forceps	Breech difficult delivery	Vertex; induced	Vertex; easy delivery
4 days	10 hr	16 hr	24 hr	12 hr	48 hr	4 days	52 hr	4 days
+	+	+	+	+	+	+	0	+
+	+	+	NR	+	+	+	NR	+
+	+	+	+	+	+	+	+	+
NR	+	+	NR	+	0	+	+	+
+	+	+	+	+	NR	+	NR	+
NR	+	+	NR	NR	0	+	0	+
NR	NR	+	NR	NR	+	+	0	NR
+	NR	+	+	+	0	+	0	+
NR	+	+	+	+	+	+	0	0
NR	+	+	NR	NR	+	+	0	+
0	0	0	0	0	+	+	0	0
Xanthrochromic	Bloody	NR	Bloody	Bloody	Bloody	Bloody	Bloody	Bloody
0	NR	0	0	0	NR	NR	NR	0
0	Nystagmus	0	0	Sixth nerve palsy	0	Bilateral sixth nerve paresis	0	Skew eye deviation
+	+	+	+	+	+	+	0	0
Excellent	Excellent	Satisfactory	Good	Retarded	Post-operative death	Post-operative death	...	...
0	0	+	+	+	0	0	0	0

\* + indicates present; 0, absent; and NR, not recorded.

It must be emphasized, however, that this process should be suspected prior to the CT scan in order that the proper cuts can be obtained.

From our case, a second important point can be emphasized. The increased densities in the region of the caudate nuclei could be interpreted as intraparenchymal or subependymal hemorrhages, when, in fact, they were actually pooled intraventricular blood overlying the head of the caudate nuclei. This fortuitous superimposition of intraventricular blood is of clinical importance since in premature infants this area is the site of the germinal matrix or ganglionic eminence, which, in turn, is a major source of intraventricular hemorrhage. Again, this type of problem re-emphasizes the continued necessity of pathologic correlation with CT scan in order to become aware of artifacts that could be erroneously interpreted as specific processes.

After a period of normalcy, any term newborn infant in whom a tense fontanelle, increasing head circumfer-

ence, lethargy, irritability, and respiratory irregularities develops should be evaluated for a posterior fossa subdural hematoma. If a CT scan is readily available, the clinician involved in interpretation should be made aware of the possibility of posterior fossa hemorrhage so that the correct levels of scans are made and that the dural sinuses are distinguished from hemorrhage. If the CT scan is not available, supratentorial and, if necessary, infratentorial subdural taps should be done.<sup>13</sup> The elapsed time must be minimized in order to salvage the infant and perhaps prevent secondary communicating hydrocephalus.

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