CT Measurements of Cranial Growth: Microcephaly

Computed tomographic (CT) head scans were measured to determine the cranial dimensions of four children with microcephaly. These measurements were compared with cranial dimensions of normal children. CT proved to be useful in determining the developmental status of children with neurologic problems relative to their normal counterparts on the basis of cranial dimensions.

Normal cranial size as determined from computed tomographic (CT) scans for subjects of different ages has been described [1]. We submit four clinical cases whose proven microcephaly further validates these published values. The cranial area and dimensions measured on CT scans correlate well with published head circumference growth charts obtained by measuring maximal cranial circumferences with tape measures [2–10].

Materials and Methods

CT head scans were obtained with a GE 8800 scanner using a 9.6 sec, high-resolution mode. A standardized position with an approximate 5°–10° tilt from the canthomeatal line was used. The midventricular head section that demonstrated the largest size of the frontal horns of the lateral ventricles was selected for evaluation of head size. Using the built-in cursor, the edge of the outer cranium was traced and the enclosed cranial area was calculated by the computer. In addition, the maximum anteroposterior and lateral diameters of the cranium were also measured by the computed or grid measurement or both. The same window setting (level at 35 and width 100) was used for screen viewing and filming.

Case Reports

Case 1

A 13-month-old girl was diagnosed at age 3 weeks as having congenital brain infection of uncertain etiology. She was mentally retarded and had a seizure disorder. Her head circumference was 37.7 cm, less than the third percentile for her age, and was at the 50th percentile for 1½ months of age [2]. CT (fig. 1) showed diffuse periventricular calcifications associated with severe ventriculomegaly and the thickening of the calvarium. Her head was microcephalic, as determined by calculated head area (89 cm²), a value less than the fifth percentile for her age, and at the 50th percentile for age 2 months. The product was 124 cm² (12.6 × 9.8 cm), again less than the fifth percentile for her age and at the 50th percentile for 2 months of age. The probable radiographic diagnosis was toxoplasmosis, but viral infectious diseases could not be excluded.

Case 2

A 2-year-old girl was considered small for gestational age at birth. She did well for the first 3 months of life, at which time she developed fever, seizures, and vomiting. Bilateral subdural hematomas were found at another institution; their etiology was never established. Subsequently, she showed marked psychomotor retardation, and her seizures were very difficult to control, despite numerous anticonvulsants. CT (fig. 2) showed marked ventriculomegaly...
Modern scanners, with their built-in cursor ability to measure distances and areas, provide an opportunity for those who review CT scans to determine cranial sizes directly from the scans. Problems of the brain associated with cranial dimensions, such as microcrania, can therefore be assessed easily from CT scans. Cases 1 and 2 demonstrated microcephaly, severe brain atrophy, and ventriculomegaly. These symptoms suggest that brain growth was retarded or arrested after trauma or infection. The patterns of brain growth can thus be estimated by CT head scans. The cranial growth pattern assessed by CT head areas correlates well with the head circumference assessed via tape measurement. Hence, the CT measured head area should be useful and can be used as a supplementary tool for measurements of head circumference.

REFERENCES