DEEP CALCARINE SULCUS AND PROMINENT CALCAR AVIS

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SUMMARY

MR imaging examinations of the brain 100 consecutive patients, ages ranging from 1 year to 66 years, were evaluated in order to investigate the frequency of a deep calcarine sulcus and prominent calcar avis. Twenty-four cases (24 %) were found with a deep calcarine sulcus and prominent calcar avis. These were bilateral in four patients, and unilateral in twenty. Fifteen of the unilateral cases demonstrated a right-sided involvement, and remaining five were left-sided. A deep calcarine sulcus and prominent calcar avis should be distinguished from disorders of neuronal migration and organization such as schizencephaly and heterotopia. Also, based on our findings in this study, we speculate that it is the deep calcarine sulcus and prominent calcar avis which creates the appearance of the so-called accessory occipital ventricle.


INTRODUCTION

The normal calcarine sulcus is an horizontally oriented sulcus ending at the calcar avis, which is located at the level of the temporoparietooccipital junction [1, 2]. On MR images of the brain, the appearance of a deep calcarine sulcus and prominent calcar avis may be mistaken for a pathological condition. For this reason, we investigated the frequency of a deep calcarine sulcus and prominent calcar avis.

SUBJECTS AND METHODS

MR imaging examinations of the brain in 100 consecutive patients were evaluated in a effort to note the frequency of a deep calcarine sulcus and prominent calcar avis, which normally is a horizontally oriented sulcus ending at the calcar avis, and separating the cuneus from the lingual gyrus. There were 54 males and 46 females, ages ranging from 1 year to 66 years (mean = 29.4 years). The MR imaging examinations were performed either at 1.5 Tesla (Magnetom, Siemens, Germany) or at 0.5 Tesla (Vectra, General Electric, USA). All the subjects had spin-echo MR images in three orthogonal planes (sagittal, axial, and coronal). Patients with lesions causing distortion of the brain anatomy were excluded.

Besides this, we reviewed our MR archive consisting of disorders of neuronal migration and organization (n = 98 patients) in an effort to find cases with schizencephalic clefts and nodular heterotopia that are located medial to the lateral ventricular wall.
Fig. 1. – Axial, T1-weighted MR image shows deep calcarine sulcus and prominent calcar avis on both sides. That on the right side is more prominent creating the appearance of the so-called accessory occipital ventricle (arrow).

Fig. 1. – IRM. Coupe axiale en T1 pondérée. Scissure calcarine profonde et calcar avis proéminent bilatéral. L’avis droit est plus proéminent donnant un aspect de ventricule occipital accessoire (flèche).

Fig. 2. – Coronal, T1-weighted MR image (contrast enhanced) shows a deep calcarine sulcus (long arrow), and a prominent calcar avis (short arrow) on the right side. The condition differs from schizencephaly by normal cortical thickness of the calcarine sulcus, and by its ending at the calcar avis. Conversely, the prominent calcar avis differs from nodular heterotopia as it is the extension of the deep calcarine sulcus.

Fig. 2. – IRM. Coupe coronale en T1-pondérée (après injection de produit de contraste) montrant une scissure calcarine profonde (flèche longue) à droite. Notez la différence par rapport à la schizencéphalie par l’épaisseur corticale normale de la scissure calcarine et sa terminaison au niveau de l’avis calcar. L’avis calcar proéminent diffère de l’hétérotopie nodulaire par l’extension de la scissure calcarine profonde.

Fig. 3. – Coronal, T1-weighted MR image (contrast enhanced) shows a deep calcarine sulcus, and a prominent calcar avis on the right side (arrow). Note an enhancing vein within the sulcus.

Fig. 3. – IRM. Coupe coronale en T1-pondérée (après injection de produit de contraste) montrant une scissure calcarine profonde et un avis calcar proéminent à droite (flèche). Notez le réhaussement d’une veine dans la scissure.

Fig. 4. – Parasagittal, T1-weighted MR image shows a prominent calcar avis (arrow).

Fig. 4. – IRM. Coupe parasagittale en T1-pondérée montrant un avis calcar proéminent (flèche).

Fig. 5. – Axial, T1-weighted MR image in a patient with subependymal nodular heterotopia shows a lesion on the lateral ventricular wall (arrowhead). Note a cleft at the region of the cingulate gyrus extending from the cortex to the ventricle (arrow), simulating a schizencephalic cleft. However, the cortices lining this cleft are not thick in contrast to that seen in schizencephaly.

Fig. 5. – IRM. Coupe axiale en T1-pondérée montrant, chez un patient ayant une hétérotopie nodulaire sousépendymale, une lésion de la paroi ventriculaire latérale (tête de flèche). Notez la fente au niveau du cingulum entre la corticale et le ventricule simulant une fente schizencéphalique. Mais les circonvolutions avoisinantes ne sont pas épaissies comme dans la schizencéphalie.
RESULTS

Twenty-four cases (24 %) were found with a deep calcarine sulcus and prominent calcar avis. These were bilateral in four patients (fig. 1), and unilateral in twenty (fig. 2, 3, 4). A deep calcarine sulcus and prominent calcar avis was seen on the right side in 15 of the 20 subjects, and on the left side in the remaining 5 subjects (right-sided predominancy rate: 3/1). In all these patients the condition gave rise to the appearance of the so-called accessory « occipital ventricle » especially on axial MR images (fig. 1), and simulated a cortical cleft and subependymal, nodular heterotopia especially on coronal MR images (fig. 2, 3).

In the review of 98 patients with disorders of neuronal migration and organization, we found 34 patients with subependymal, nodular heterotopia, and in 8 of these patients there were lesions located at the medial walls of the bodies of the lateral ventricles. However, these were remote from the region of the calcarine sulcus and calcar avis. In one patient with nodular heterotopia, we noted a medial cleft at the region of the cingulate gyrus, which extended from the cortex to the ventricle, simulating a schizencephalic cleft (fig. 5). However, the cortices lining this cleft were not thick in contrast to those seen in schizencephaly. Otherwise, we did not note any medial cleft in 16 cases in our archive with schizencephaly.

DISCUSSION

The normal calcarine sulcus is an horizontally oriented sulcus ending at the calcar avis. It separates the cuneus from the lingual gyrus, at the level of the temporoparietooccipital junction [1, 2]. We have noted in our daily neuroradiology practice that when the calcarine sulcus is deep, and as a consequence the calcar avis is prominent, the condition is sometimes mistaken for a number of variational and pathological processes.

One of these is the so-called occipital ventricle, a variational process. According to a few previous studies carried out by CT, small, separate, hypodense structures that are seen at the tip of the occipital horns represented occipital ventricles, and they were called either accessory cerebral ventricles or accessory occipital ventricles [3, 4]. The authors reported prevalences of 17 % to 21.3 % for accessory occipital ventricles on CT, and in some cases a true ependymal fusion resulting in sequestration of these ventricles were shown by histology [3]. Based on our findings in this study covering the MR imaging appearance of the prominent calcar avis and its frequency (24 %) which was similar to those given for the accessory occipital ventricle, we speculate that it is the deep calcarine sulcus and prominent calcar avis which creates the appearance of the accessory occipital ventricle, and in some cases, which leads to a true ependymal fusion as a consequence of longstanding pressure effects (fig. 1).

The pathological conditions, which a deep calcarine sulcus and prominent calcar avis may simulate, are schizencephalic clefts, and subependymal, nodular heterotopia. It is known that these are disorders of neuronal migration and organization. In schizencephaly there is a pial-ependymal seam, a cleft lined with relatively thick polymicrogyric gray matter. The cleft may be narrow (closed lip) or wide (open lip) [5]. On the other hand, subependymal, nodular heterotopia consists of clusters of neurons [5]. For these reasons, a deep calcarine sulcus may simulate a narrow (closed lip) schizencephalic cleft, and a prominent calcar avis may simulate heterotopia. However, it is known that all types of schizencephalic clefts are usually encountered in the cerebral parenchyma lateral to the bodies of the lateral ventricles [5]. This was verified by our own study that we did not note any medial true schizencephalic cleft in 16 cases with schizencephaly. In one patient we noted a medial cleft at the region of the cingulate gyrus, which extended from the cortex to the ventricle, simulating a schizencephalic cleft. However, the cortices lining this cleft were not thick in contrast to those seen in schizencephaly. Probably it was a cleft unrelated with a migrational etiology, although the patient had associated subependymal heterotopia (fig. 5).

Recognition of the location of the normal calcarine sulcus, and when it is deep, recognition of its impression on the medial wall of the posterior horn of the lateral ventricle, the so-called calcar avis, should enable their distinction from disorders of neuronal migration and organization. On the other hand, we believe that it is the deep calcarine sulcus and prominent calcar avis which creates the appearance of the accessory occipital ventricle.

REFERENCES