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Original Article

Cutis Verticis Gyrata: A Rare Finding in Cranial Magnetic Resonance Imaging that Is Usually Overlooked

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Abstract

Objective: Cutis verticis gyrata is a rare condition of scalp thickening, characterized by deep grooves and gyriform ridges that can be observed on computed tomography scans and magnetic resonance imaging. It is a benign and asymptomatic condition, but sometimes, it may be associated with some systemic diseases in the secondary form.

Methods: Review of the 4026 magnetic resonance imaging studies from a clinics' archive revealed 29 patients with cutis verticis gyrata. Obtained images were re-evaluated for symmetry, localization, and direction. History and previous medical records of the subjects were evaluated, and laboratory or clinic findings that could be related to cutis verticis gyrata were noted.

Results: Around 44.8% (n=13) of the subjects were male and 55.2% (n=16) were female. Age range was 28-87 years with a mean of 61.10 ± 15.25 years. Evaluation of the history and previous medical records of the subjects revealed no laboratory and no clinic findings that could be related with cutis verticis gyrata; therefore, the cases were accepted as primary. About 21 patients had bilateral involvement, which was asymmetric in 8 of them; 24 patients (82.8%) had a chronic disease, 11 out of them (37.9%) had diabetes mellitus, 15 (51.7%) had hypertension; 18 cases (62.1%) had magnetic resonance imaging signs of small vessel disease.

Conclusion: When encountered during radiological imaging, clinicians must be aware of possible diseases that may be associated with cutis verticis gyrate, and further investigations may be performed to rule out these diseases.

Keywords: Cutis verticis gyrata, magnetic resonance imaging

INTRODUCTION

Cutis verticis gyrata (CVG) is a rare condition of scalp thickening, characterized with deep grooves and gyriform ridges, sometimes giving a spiky cogwheel appearance on computerized tomography (CT) scans and magnetic resonance imaging (MRI).[1,2] Cutis verticis gyrata has a primary form, where there is no known etiology, and this form may be associated with mental retardation, cerebral palsy, epilepsy, cataract, and blindness.[3,4] It may also be secondary to local scalp diseases, genetic syndromes, minoxidil and testosterone use, and endocrine and systemic diseases like acromegaly.[3] It is estimated that CVG is seen in 1 in 100 000 males and in 0.026 in 100 000 females.[4] In histopathological examination, there is hypertrophy of sebaceous structures with no evidence of collagen thickening. Overgrowth of the scalp in the form of CVG is observed in 10%-15% of acromegaly patients. The ridges of the skin in CVG develop due to the overgrowth of the scalp on a narrow surface limited by scalp fascia. Secondary form of CVG regresses after the treatment of the underlying condition, but sometimes, surgical interventions may be necessary.[4]

In the present article, we aimed to document 29 cases who had CVG apparent on MRI images. We obtained demographic and clinical data of the cases, like the presence of systemic diseases, and aimed to discuss available information and compare this with that of similar reports from the literature.

METHODS

Patients and Magnetic Resonance Imaging Protocol

Our MRI archive containing 4026 MRI studies of the head for the period from October 2021 to October 2022 was reviewed after obtaining local ethical committee's approval. Review of the MRI archive revealed 29 patients with CVG. A 3T MRI (MAGNETOM Skyra, Siemens Healthcare, Erlangen, Germany) had been used. The performed magnetic resonance examinations yielded 3-mm thick coronal and axial images. Patients were examined with conventional sequences like sagittal spin-echo T1-weighted images (T1WI), axial and coronal spin-echo T2-weighted images (T2WI), and axial fluid attenuation inversion recovery sequence (FLAIR) and standard head coils were used. Obtained images were re-evaluated for symmetry, localization, and direction. History and previous medical records of the subjects were evaluated, and laboratory or clinic findings that could be related to CVG were noted.

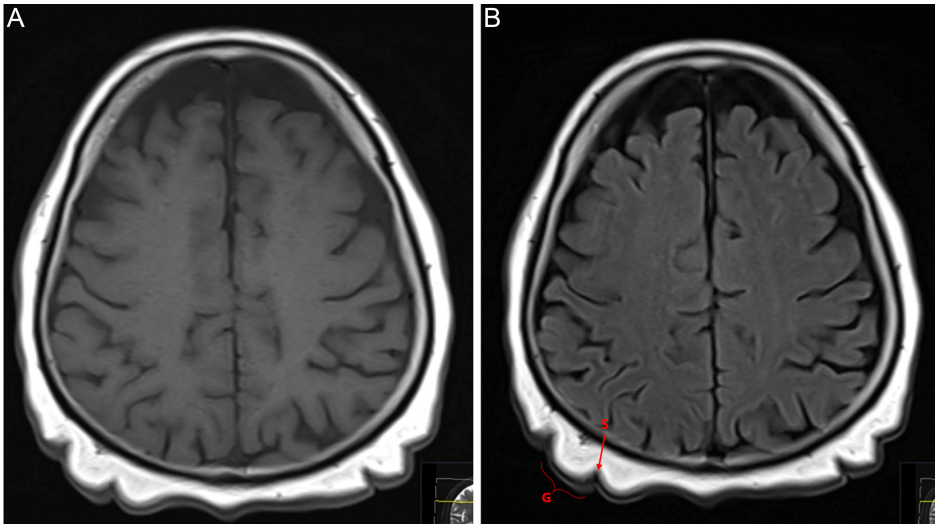

Figure 1. T1- and T2-weighted axial magnetic resonance images demonstrate cutis verticis gyrata on the scalp without any cerebral abnormalities. G, gyriform structure; S, sulcal morphology.

Statistical Analysis

Statistical analyses were made with the International Business Machines' Statistical Package for the Social Sciences version 22.0. (IBM SPSS Corp.; Armonk, NY, USA). The distribution of the numerical data was analyzed with Shapiro–Wilk test; Independent samples *t*-test was used for group comparisons. Analyses of categorical variables were made with Fisher's exact or Fisher–Freeman–Halton test. Descriptive statistics for numerical variables were given as mean and standard deviations and for categorical variables with numbers and percentages. A statistically significant value of $P < .05$ was used.

RESULTS

Around 44.8% (n=13) of the subjects were male and 55.2% (n=16) were female. Age range was 28-87 years with a mean of 61.10 ± 15.25 years. None of the patients had a complaint related to scalp thickening and CVG was observed incidentally during brain MRIs, performed for various other indications. Evaluation of the history and previous medical records of the subjects revealed no laboratory and no clinic findings that could be related to CVG; therefore, the cases were accepted as primary.

Characteristic ridges and grooves of the scalp were apparent on coronal images and they were mostly seen at the vertex (Figure 1). They were running anteroposteriorly and extended up to the occipital region. Signal intensities of the ridges and grooves were normal. No endocrine investigation was found in their records. All CVG cases had a generalized thickening of the skin, but in only 5 cases, the scalp was extensively corrugated and had a wavy appearance, demonstrating a cogwheel pattern.

MAIN POINTS

- Cutis verticis gyrata (CVG) is a rare condition of scalp thickening.
- Cutis verticis gyrata is characterized by deep grooves and gyriform ridges, sometimes giving a spiky cogwheel appearance on thickening scalp on sectional imaging.
- This condition has a primary and a secondary form.
- The secondary form of the disease can be associated with many systemic conditions.

About 21 patients had bilateral involvement, which was asymmetric in 8 of them (Figure 2). In all patients, CVG was seen in the vertex with variable anterior or posterior extensions to the frontal or occipital regions. Transverse folds were better visualized on the sagittal plane, whereas longitudinal CVG folds were clearer on the coronal plane. Calvarium was normal in all patients.

Co-existing diseases are listed in Table 1. Totally 24 patients (82.8%) had a chronic disease and 11 of them (37.9%) had diabetes mellitus (DM) and 15 (51.7%) had hypertension (HT). In 18 cases (62.1%), there were MRI signs of small vessel disease (SVD) (Figure 3). One patient also had normal pressure hydrocephalus (Figure 4).

DISCUSSION

Cutis verticis gyrata has a primary and a secondary form. The cases in the present study had no condition in their medical records that would be related to CVG; therefore, all cases were considered primary. Although these were all primary cases, there was no mental retardation, cerebral palsy, epilepsy, cataract, and blindness either, which are the conditions that could be associated with the primary form. This form of primary CVG, which is not associated with these abnormalities, is called the primary essential form.[4]

Primary essential form constitutes 79.6% of all primary cases,[5] whereas all cases of our study group were of the primary essential type. In a larger group of CVG patients, non-essential type would also be encountered and the ratio that we found may change.

Asymptomatic cases of essential primary CVG, where the ridges and grooves are not that prominent, may be overlooked by both the clinicians and radiologists.[5] There were only 5 cases in our group who had prominent grooves and ridges. It is quite possible to overlook milder cases, especially when the orientation of the ridges and grooves is parallel to the imaging plane.

The characteristics of the ridges and grooves were similar to other studies. It was reported that the ridges and grooves have usually an anteroposterior direction except for the ones in the occipital region, where

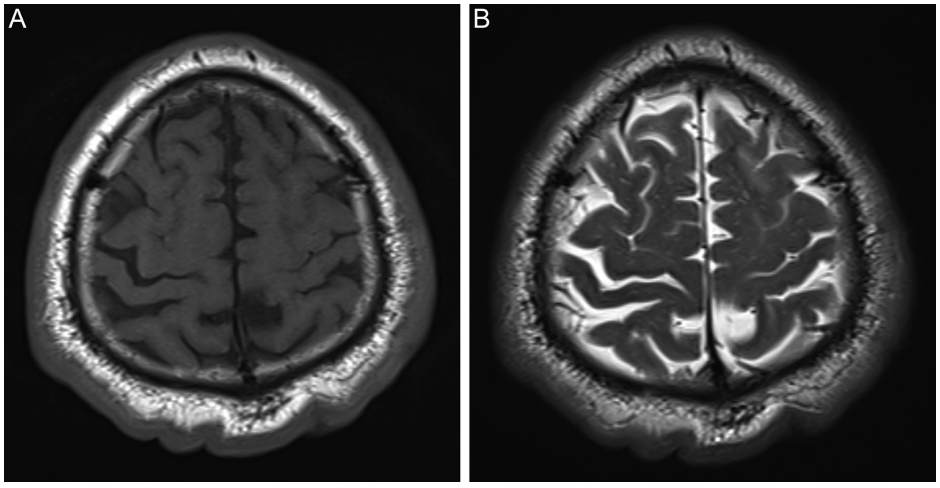

Figure 2. Axial T1- and T2-weighted magnetic resonance images show mild and asymmetric cutis verticis gyrata morphologies.

Table 1. Co-existing Conditions of CVG

	n	%
Chronic disease	24	100
Diabetes mellitus (DM)	5	20.8
Hypertension (HT)	9	37.5
DM+HT	6	25
Other diseases	4	16.7

CVG, cutis verticis gyrate.

they are usually obliquely oriented.[5] A similar orientation pattern was observed also in our cases.

Cutis verticis gyrata is seen in 1 in 100 000 males and in 0.026 in 100 000 females.[4] Around 29 CVG patients on 4026 MRI images appear to be a very high rate. An explanation might be that the CVG prevalence given in the present article is not from a radiological study. Although there are no big series reported yet in the literature, we believe that CVG prevalence, especially the prevalence of the secondary form, might increase with the increase in the use of cross-sectional imaging. In addition, there are studies that report incidences of up to 12.5% in certain psychiatric diseases.[6,7]

Male to female ratio in the present study was 13 : 16. Cutis verticis gyrata was more common in female patients, which is in contrast with Okamoto et al's[5] study where it was reported that male to female ratio was 5-6 : 1. The cases from the present study consist of non-symptomatic CVG cases who had undergone MRI for different indications. The cases we detected may not be representing all CVG cases during the same time period and our findings may not be reflecting a correct male-to-female ratio.

Both HT and DM seemed frequent in the CVG cases. The prevalence of DM in Turkey is 16.5% according to the TURDEP II study from 2013,[8] whereas the prevalence of HT is 30.3% according to Sengul et al[9] Our CVG group has a relatively higher age (61.10 ± 15.25 years) in contrast to the study populations of the prevalence studies, which consist of adults older than 20 years of age. It is known that HT and DM are more frequent in older ages.[8,9] The increased rate of HT and DM among CVG cases could not be associated with the presence of

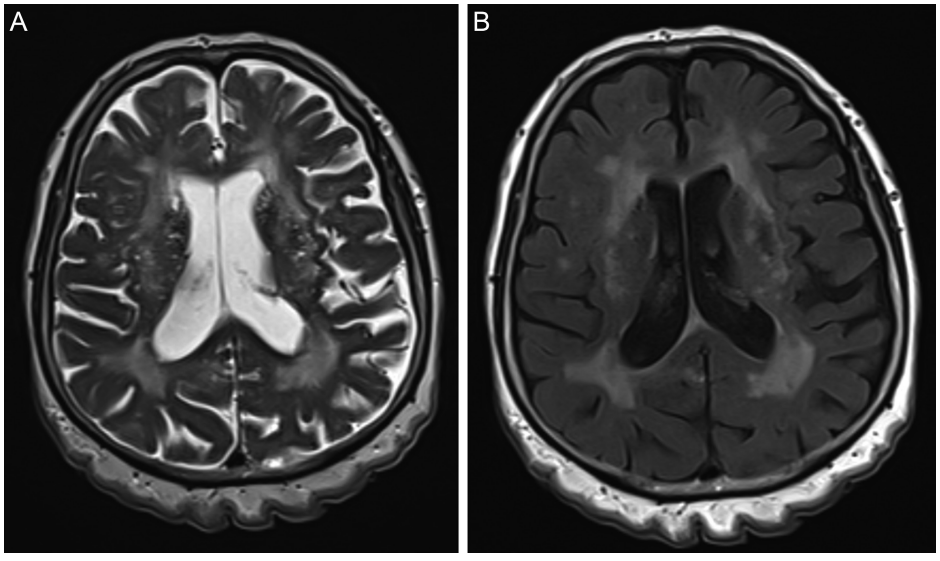

Figure 3. Axial T1- and T2-weighted magnetic resonance images show small vessel plaques associated with cutis verticis gyrata.

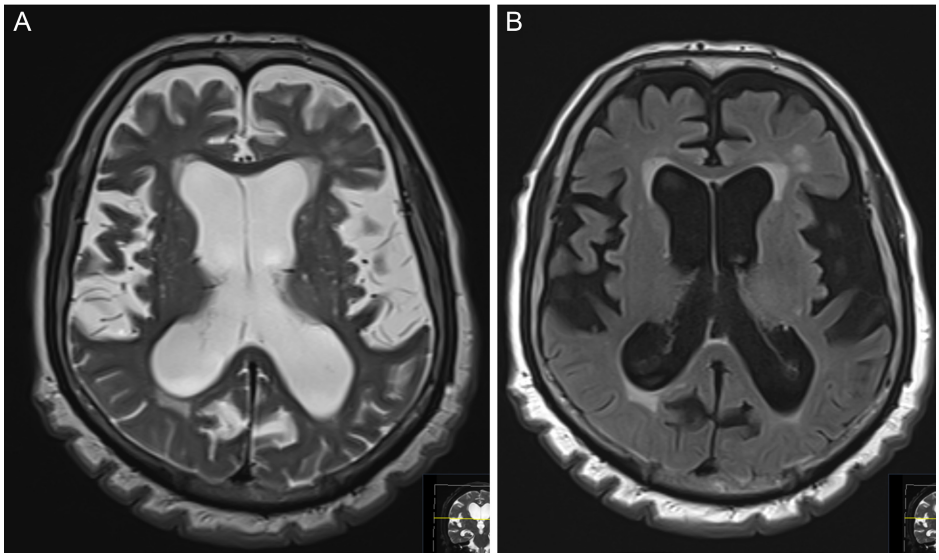

Figure 4. Axial T1- and T2-weighted magnetic resonance images reveal coexistence of both cutis verticis gyrata and normal pressure hydrocephalus.

CVG, because we do not have a comparable prevalence data from a matching non-CVG population.

In 62.1% of cases, there were MRI signs of SVD. White matter lesions and lacunar infarcts are referred to as SVD and it is a common finding in MRI and CT images of elderly people. Small vessel disease is related to some diseases that are vascular risk factors like atherosclerosis, hypertension, DM, and atrial fibrillation.[10,11] We observed higher percentages of both hypertension and DM in our cases; therefore, the percentage of SVD was also relatively high as expected. Chronic kidney disease, obstructive sleep apnea, current and former smoking, and branch atheromatous disease are other risk factors for SVD.[12]

The present study was conducted retrospectively. That the evaluation was made on routine head and neck cranial imaging, rather than specific imaging planned especially for CVG, has been a limitation of the present study. A prospective study with detailed maxillofacial examination data and sequence optimization for a better scalp evaluation could reveal more reliable data. According to our knowledge, there are no established criteria for the radiological distinction of CVG from cutis laxa (CL). Cutis verticis gyrata is basically a dermatological diagnosis. For the distinction of CVG from CL, some physical examination maneuvers are necessary on a clinical basis. The retrospective setting of the present study was not appropriate to make a clear distinction because each patient had not been examined specifically for CVG. Therefore, it is possible that some of our cases might have CL. This has been another major limitation of our study. Further studies are necessary, in which clinicians and radiologists will work in cooperation.

In conclusion, CVG is a rare and benign condition of the scalp characterized by deep grooves, gyriform ridges, and thickened skin. There is a primary and secondary form. The secondary form is associated with systemic diseases like acromegaly. Neuroradiologists should be aware of this scalp condition to interpret its characteristic radiological findings correctly and remind clinicians to rule out possible systemic diseases that may be underlying or co-existing with this benign condition.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Düzce University Date: November 7, 2022 Decision No: 2022/200.

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – D.G., H.O.; Design – D.G., H.O.; Supervision – D.G., H.O.; Materials – O.Ş.O., H.O.; Data Collection and/or Processing – D.G., O.Ş.O.; Analysis and/or Interpretation – D.G., O.Ş.O.; Literature Review – D.G.; Writing – D.G.; Critical Review – H.O.

Declaration of Interests: The authors declare that they have no conflicts of interest.

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