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Case Report

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Bilateral Thinning of the Temporal Bone: A Case Report

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ABSTRACT

Bone mass is maintained by a balance between bone formation by osteoblasts and resorption by osteoclasts. Calvarial thinning can occur because of various factors. However, no previous studies have described bilateral temporal thinning (BTT) of the skull. This report presents a case of a squamous part of the bilateral temporal bone in a patient with alcohol-induced liver cirrhosis. This is the first case of BTT exhibiting an appearance similar to that of bilateral parietal thinning (BPT) in a patient with osteoporosis caused by liver cirrhosis. Although the precise pathogenic mechanism underlying thinning of the squamous part of the temporal bone remains unclear, osteoporosis associated with diploë is presumed to have contributed to its development in this patient, and BTT is considered a variant of BPT.

KEYWORDS: Bone formation, Liver cirrhosis, Osteoporosis

INTRODUCTION

Bone mass is meticulously maintained by a delicate balance between bone formation by osteoblasts and bone resorption by osteoclasts. Disruption of this tightly regulated equilibrium maintained by the intricate crosstalk between osteoblasts and osteoclasts can lead to bone thickening and thinning (5). Calvarial thinning can arise from various factors, including bilateral thinning of the parietal bones, osteogenesis imperfecta, hypophosphatasia, achondrogenesis, Menkes syndrome, craniofacial syndromes, arachnoid cyst, mega cisterna magna, and peripherally located tumors (4). However, no previous studies have documented bilateral temporal thinning (BTT) of the skull. To our knowledge, this is the first documented case of BTT in a patient with alcohol-induced liver cirrhosis. The author also proposes a possible mechanism to explain this rare case.

CASE REPORT

A 49-year-old male patient presented to the hospital with noticeable depression of the bitemporal region of his head, which gradually worsened over the prior few years. He denied having a history of head trauma. Despite complaints of dull sensations in both legs, neurological examination revealed no abnormalities. Physical examination revealed significant depression in the temporal areas bilaterally. The patient's medical history included liver cirrhosis, esophageal and gastric cardiac varices, and splenomegaly, all of which were attributed to long-term alcohol consumption. The patient's medical history included liver cirrhosis, esophageal and gastric cardiac varices, and splenomegaly, all of which were diagnosed three years prior and were attributed to long-term alcohol consumption. Under these conditions, the patient was continuously taking ursodeoxycholic acid, silymarin, and spironolactone. Laboratory tests related to bone metabolism and hormone levels were within normal limits, including serum calcium at 9.1 mg/dL (normal range: 8.5–10.2 mg/dL), phosphate at 3.5 mg/dL (2.5–4.5 mg/dL), alkaline phosphatase at 83 IU/L (44–147 IU/L), parathyroid hormone at 42 pg/mL (10–65 pg/mL), 25-hydroxyvitamin D at 79 ng/mL (30–100 ng/mL), and rheumatoid factor at 1.2 IU/mL (0–15 IU/mL). Laboratory test results for bone metabolism and hormone levels were within normal limits. The patient's bone mineral density T-score was -3.5, indicating osteoporosis. A cranial computed tomography (CT) scan revealed focal thinning of the bilateral temporal bones, measuring only 0.7 mm in thickness (Figure 1). Cranial CT performed six years earlier showed no thinning or abnormalities (Figure 2). A whole-body bone scan did not reveal any focal areas of abnormal radiotracer uptake in the cranial bones (Figure 3).

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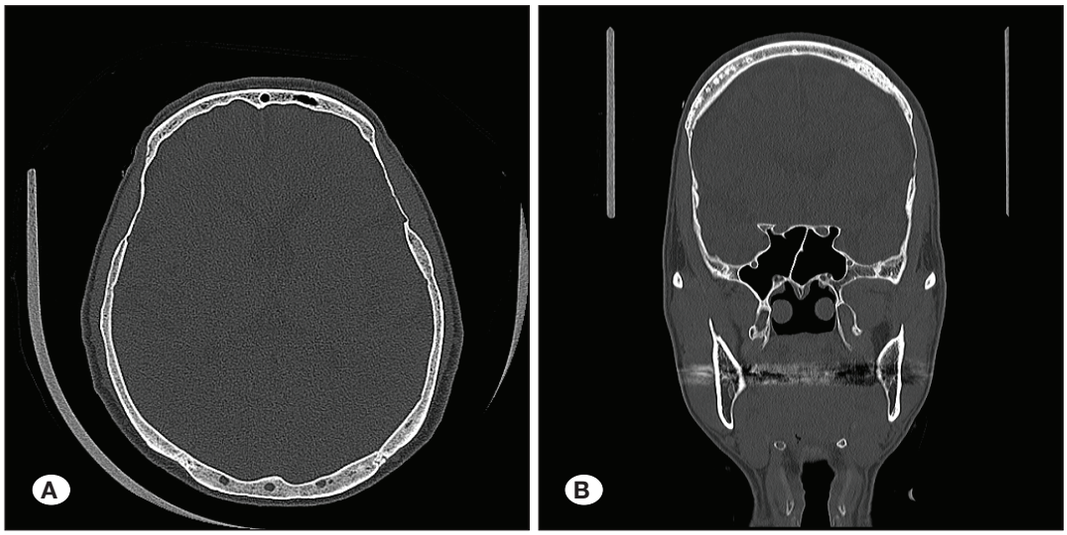

Figure 1: Axial **(A)** and coronal **(B)** cranial computed tomography scan showing focal thinning of the bilateral temporal bones, with a thickness of 0.7 mm.

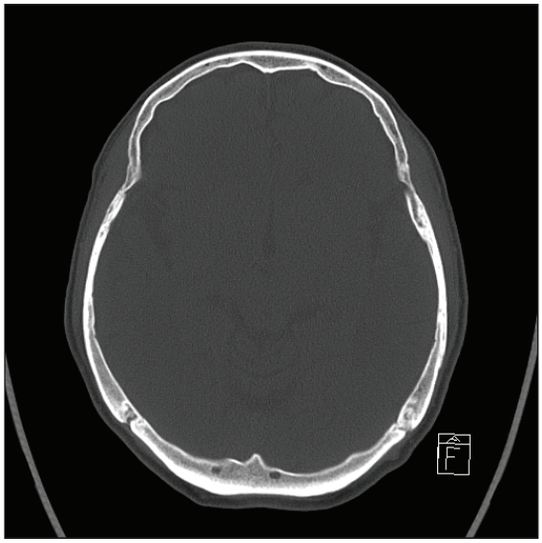

Figure 2: Axial cranial computed tomography obtained six years ago showing no thinning or abnormalities.

DISCUSSION

Calvarial lesions can be classified into the following three categories: 1. single or multiple lytic lesions, 2. focal or multiple diffuse sclerotic lesions, and 3. focal or diffuse calvarial thinning. Common causes of calvarial thinning include neoplastic or transdiploic lesions and osteomyelitis, whereas uncommon causes include Parry-Romberg syndrome (facial hemiatrophy), flap osteonecrosis, Gorham disease, and bilateral parietal thinning (BPT). Diffuse calvarial thinning may be caused by convolutional markings, copper-beaten skulls, lacunar skulls, and craniosynostosis (4). BPT exhibited a pattern of local calvarial thinning similar to that of the patient in this case. BPT of the skull was first described in the 18th century (2). It is a rare acquired disease, affecting an estimated 0.25%–0.8% of the population and is more prevalent in women than in men (2,7). BPT is typically characterized by the thinning of the bilateral parietal bones between the midline sagittal suture and the lateral parietal eminence (5). Cranial radiographs of BPT demonstrate symmetrical thinning of the bilateral parietal bones involving the outer table and diploë of the skull, resulting in a scalloped appearance (2,7,8).

In the present case, the patient experienced bilateral symmetrical thinning of the squamous portion of the temporal bone, resembling BPT. Although both the temporal and parietal bones are classified as flat bones, the temporal bone is more complex in structure, and its histological organization is slightly different because of its involvement in both hearing and cranial protection (3). The temporal bone is composed of several parts: the petrous, squamous, tympanic, and mastoid parts (3). The petrous part contains highly dense, compact bone with few spaces, reflecting its role in protecting delicate structures such as the cochlea and vestibular apparatus. The squamous part forms the lateral walls of the cranium, is relatively thin, and has a flatter bone structure. This part has a larger amount of diploë between the outer and inner layers of the compact bone, making it less dense than the petrous part. The mastoid part is characterized by the presence of mastoid air cells, which are air-filled cavities. These are lined with a thin layer of bone that forms trabeculae, a characteristic not observed in the parietal bone (3). The parietal bone is a typical flat bone, more uniform in structure, consisting of compact bone layers with a diploë. There are no specialized air cells or extremely dense regions, such as in the temporal bone. In the present case, the patient exhibited bilateral calvarial thinning in the squamous part of the temporal bone, which contained the parietal bone diploë. Baek et al. reported two cases of idiopathic calvarial thinning occurring bilaterally in the frontal squama with a pattern similar to that of BPT (1). Frontal squama shares the same structure as the parietal bones. Therefore, the author speculates that idiopathic calvarial thinning occurs in the flat bone containing diploë. Histological examinations in previous studies supported this conjecture (1,8). The diploë is particularly susceptible to the effects of osteo-

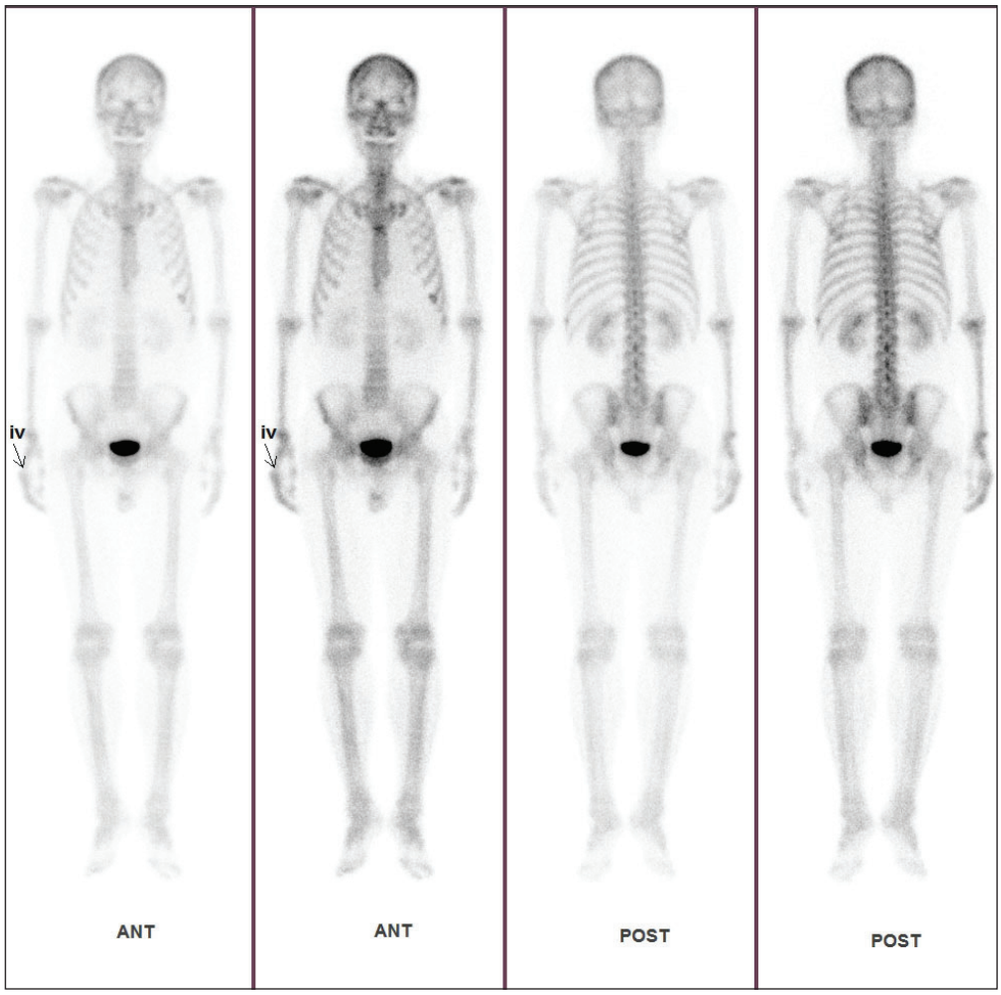

Figure 3: Whole body bone scan showing no focal areas of abnormal radiotracer uptake in the cranial bones.

porosis because of its trabecular structure and large surface area for bone turnover. Osteoporosis weakens the diploë by reducing the strength and number of trabeculae, leading to an increased risk of fractures, especially in bones rich in diploë, such as the vertebrae and pelvis (6). Osteoporosis, a major cause of bone thinning, is more common in women, which may explain why BPT occurs more frequently in women (2,7).

While the exact pathogenesis of BPT remains elusive, various theories have been proposed to explain the pathogenesis of this rare condition. One hypothesis suggests an association between postmenopausal age and senile osteoporosis (2,7,8). Histopathological studies have demonstrated a lack of osteoclasts, implying that BPT may be linked to osteoporosis resulting from decreased bone formation rather than increased bone destruction (2). In the present case, the patient presented with liver cirrhosis, secondary alcohol consumption, and concomitant osteoporosis. Undeniably, osteoporosis in this patient contributed to the development of BTT. Laboratory findings related to bone metabolism and hormone levels were within the normal limits. Zheng et al. reported an osteoporosis prevalence of 20.3% in patients with cirrhosis, which was attributed to liver viruses and alcohol abuse (9). Previous studies have shown that individuals with alcoholic liver disease exhibit a higher propensity for developing osteoporosis or osteopenia than those with chronic viral hepatitis (9). This may be attributed to the detrimental effects of alcohol consumption on osteoblast number and activity, along with its potential to impair nutrition and hormone secretion for bone remodeling. Furthermore, the activation of inflammatory cells in patients with liver cirrhosis can promote the production of pro-inflammatory factors such as tumor necrosis factor and interleukin-1, which can contribute to bone mass reduction. In the present case, thinning of the squamous part of the temporal bone closely resembled BPT both radiologically and histologically. Although the exact pathophysiology remains unknown, it is believed to be related to the diploë, which is most abundant in the parietal bones, as nearly all cases of calvarial thinning affect the parietal bones bilaterally. Therefore, the patient's condition is considered a variant of BPT.

CONCLUSION

To our knowledge, this is the first documented case of BTT with a presentation similar to that of BPT in a patient with

osteoporosis caused by liver cirrhosis. Although the precise pathogenic mechanism underlying thinning of the squamous part of the temporal bone remains unclear, osteoporosis associated with diploë is presumed to have contributed to its development in this patient, and BTT is considered a variant of BPT. Further studies are needed to elucidate the clinical, radiological, and histopathological characteristics of this rare disease.

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Declarations

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Availability of data and materials: The datasets generated and/or analyzed during the current study are available from the corresponding author by reasonable request.

Disclosure: The authors declare no competing interests.

Ethics Approval: This study was approved by the ethics committee of Wonkwang University Hospital (approval No. 202311065).

AUTHORSHIP CONTRIBUTION

Study conception and design: KSE
Data collection: KSE
Analysis and interpretation of results: KSE
Draft manuscript preparation: KSE
Critical revision of the article: KSE
Other (study supervision, fundings, materials, etc...): KSE
All authors (KSE) reviewed the results and approved the final version of the manuscript.

REFERENCES

1. Baek S, Hong N, Rhee Y: Two cases of frontal variation of idiopathic calvarial thinning-therapeutic effect of denosumab and romosozumab. JCEM Case Rep 1: luad122, 2023. https://doi.org/10.1210/jcemcr/luad122
2. Cederlund CG, Andrén L, Olivecrona H: Progressive bilateral thinning of the parietal bones. Skeletal Radiol 8:29-33, 1982. https://doi.org/10.1007/bf00361365
3. Isaacson B: Anatomy and surgical approach of the ear and temporal bone. Head Neck Pathol 12:321-327, 2018. https://doi.org/10.1007/s12105-018-0926-2
4. Khodarahmi I, Alizai H, Chalian M, Alaia EF, Burke CJ, Slasky SE, Wenokor C: Imaging spectrum of calvarial abnormalities. Radiographics 41:1144-1163, 2021. https://doi.org/10.1148/rg.2021200198
5. Kim JM, Lin C, Stavre Z, Greenblatt MB, Shim JH: Osteoblast-osteoclast communication and bone homeostasis. Cells 9: 2073, 2020. https://doi.org/10.3390/cells9092073
6. Raisz LG: Pathogenesis of osteoporosis: Concepts, conflicts, and prospects. J Clin Invest 115:3318-3325, 2005. https://doi.org/10.1172/jci27071
7. Sanati-Mehrizy P, Graziano FD, Naidich T, Taub PJ: Characterization of bilateral parietal thinning. J Craniofac Surg 31:e288-e291, 2020. https://doi.org/10.1097/scs.0000000000006241
8. Tsukada A, Yanaka K, Takeda H, Onuma K, Takada M, Nakamura K, Ishikawa E: Idiopathic focal calvarial thinning: A case report. Surg Neurol Int 13:503, 2022. https://doi.org/10.25259/sni_789_2022
9. Zheng JP, Miao HX, Zheng SW, Liu WL, Chen CQ, Zhong HB, Li SF, Fang YP, Sun CH: Risk factors for osteoporosis in liver cirrhosis patients measured by transient elastography. Medicine (Baltim) 97:e10645, 2018. https://doi.org/10.1097/md.0000000000010645