

MAGNETIC RESONANCE IMAGING OF INTRACRANIAL EXTRAMEDULLARY HAEMATOPOIESIS IN β -THALASSEMIA: A CASE REPORT

Mahnour Hafeez¹, Ateeque Ahmed Khan²

¹Department of Radiology, Civil Hospital & Dow University of Health Sciences (DUHS), Karachi, Pakistan.

Correspondence address: Dr. Mahnour Hafeez; Resident PGY-IV, mahnour.hafeez@yahoo.com; Dr. Ateeque Ahmed Khan; MCPS, FCPS; Consultant & Professor.
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ABSTRACT

We report the Magnetic Resonance Imaging of intracranial extramedullary hematopoiesis in 21 years old β -thalassemic patient who presented to the Neurology Department of Civil Hospital Karachi with seizures. The MR exam revealed multiple intracranial extra-axial masses; isointense on T1W sequence and hypointense on T1W, T2W, FLAIR, DWI sequence and ADC (b value = 1000 sec/mm²) with avid post contrast enhancement. Plain CT of the Head documented the presence of multiple hyperdense extra-axial masses with mean value of 45 HU. Extramedullary hematopoiesis is the formation and development of blood cells in tissues outside of the medulla of the bone. The most common sites of involvement are the liver, spleen, and lymph nodes. Intracranial extra medullary hematopoiesis is a relatively rare manifestation of Thalassemia. There is paucity of literature for MR findings regarding intracranial EMH. It is essential to distinguish it from other central nervous system tumors, because treatment and prognosis are entirely different.

Key words: β -thalassemia; EMH; MRI; DWI; ADC; intracranial extramedullary hematopoiesis

INTRODUCTION

Thalassemia is among the most common genetic disorder worldwide. Health experts claim that approximately 5,000 children are diagnosed with thalassemia-major, every year in Pakistan. Beta-thalassemia is a hemolytic disease characterized by a gene defect in the production of beta globin chain from hemoglobin¹, which causes ineffective erythropoiesis and peripheral destruction of red blood cells. Extramedullary hematopoiesis occurs in approximately 15% of cases of thalassemia². It is a process in which the body attempts to maintain erythropoiesis by proliferation of pluripotent stem cells outside the bone marrow due to less production of blood cells in order to meet the body's demand to compensate for anemia. Apart from thalassemia, it is also observed in sickle cell anemia, leukemia and in myeloproliferative disorders such as myelofibrosis, polycythemia rubra vera³. EMH occurs most often in the spleen and liver and occasionally in the lymph nodes. Less common organs include the pleura, lungs, gastrointestinal tract, breast, skin, kidneys, and adrenal glands⁴. Intracranial extra medullary hematopoiesis is a relatively rare manifestation of Thalassemia. It can possibly involve the cranial dura, falx, cerebral parenchyma, optic nerve sheath, choroid plexus and the epidural space of the spinal canal. Usually patients

are clinically silent, headache, seizures, visual disturbance, papilledema, motor and sensory impairment, and even coma may develop⁵. Magnetic resonance imaging (MRI) remains the modality of choice for its diagnosis for its diagnosis⁶; being a noninvasive technique. We present a rare case of intracranial EMH in 21 years old thalassemic patient.

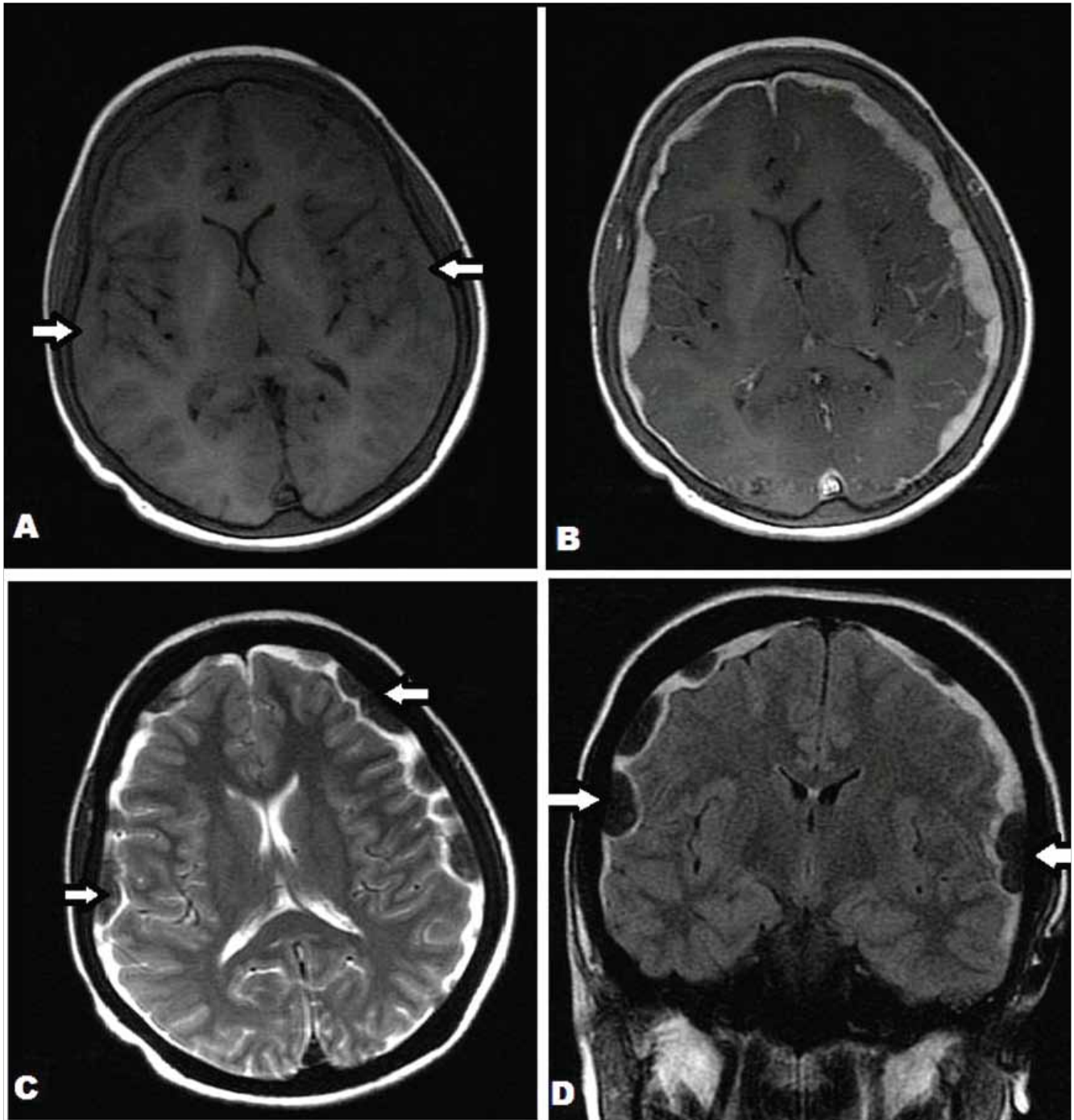
CASE SUMMARY

A 21-year-old Asian male, with known beta thalassemia, presented to Civil Hospital with complaints of low grade fever and generalized epileptiform tonic clonic seizures during the last three weeks, with recent onset headache, nausea, vomiting and blurring of vision for last 3 days. His personal history was significant for irregular blood transfusions. He was also known case of bronze diabetes. There was documented history of weight loss for last one month. The family history revealed that his parents were carriers (minor thalassemia) and his two younger sisters were also known thalassemic major. He had pallor of the skin with a cachectic appearance and a prominent skull. The patient has hyper pigmented dermal plaques over the arms and abdomen. Neurological examination was unremarkable except for bilateral mild papilledema demonstrated at fundoscopy. On admission, laboratory investigations showed hemoglobin 8 g/dl, white blood

cell count $5.33 \times 10^9/L$, platelet count $118 \times 10^9/L$ and mean corpuscular volume 77.8fl. Ultrasound exam revealed gross hepato-splenomegaly with diffuse increased echogenicity of liver with coarsening of liver parenchyma and atrophic pancreas. Magnetic resonance imaging of the brain was performed on GE Health Care SignaHDxt1.5 Tesla Scanner, using the head coil with slice thickness of 4mm with interslice width of 1mm. Multiplanar, multisequential images in T1W, T2W fast spin echo sequence, FLAIR and single shot echo planner DWI sequence at a b-value of 1000

sec/mm², along with post contrast T1W sequence were obtained. MRI revealed multiple well defined intracranial extra-axial masses

Figure 1: Axial T1- (A), post contrast axial T1 weighted- (B), axial T2 weighted Fast Spin Echo - (C) and FLAIR coronal (D) images demonstrate iso-intense T1 signal, low T2 and FLAIR signal intradural masses. The lesions shows enhancement in post contrast T1-weighted image (D) –[arrows in Fig A, C & D].



(Figure 1) over the cerebral convexities bilaterally which were isointense to gray matter on T1-weighted sequence and hypointense on T2-weighted, FLAIR sequence, Diffusion Weighted imaging and apparent diffusion coefficient (ADC) map with avid homogenous enhancement on post contrast T1-weighted sequence. The maximum width of these masses measures 20mm in transverse dimensions. No adjacent parenchymal edema was seen. It was associated with diffuse pachymeningeal thickening and enhancement. There was widening of diploic space of the calvarium which demonstrated hypointense signals on all sequences due to replacement of fatty marrow with hematopoietic marrow as a compensatory mechanism (Figure 2).

Figure 2: Para-Sagittal post contrast T1 weighted image shows widening of the diploic space [arrows] with hypointense marrow signals.



The patient underwent plain brain CT of head (Fig.3) performed with 16 slice Toshiba

Figure 3: Plain CT Head shows multiple iso to hyperdense intradural masses [arrows] spiral CT [scanning parameters of 120 KV, 150mA and 5mm slice thickness] which showed multiple iso to hyperdense intradural masses with mean value of 45 HU.



DISCUSSION

Our case describes 21 years old thalassemic patient with history of irregular blood transfusion and now presented with GTC seizures for short duration of time. MR Brain with epilepsy protocol was done to identify the epileptogenic focus. His MRI demonstrated multiple extra-axial T1 isointense and in particularly T2, FLAIR, DWI hypointense masses with avid post contrast enhancement. The T2 blackout phenomenon was noted in our case which leads to hypointensity on DWI and T2W images. Bivek Karki et al¹ in his case report for similar signal intensity lesion 13-year-old beta-thalassemic patient with left sided paresis, initially proposed the differential diagnosis of multiple meningioma, dural metastasis, lymphoma and granuloma. It was emphasized that meningioma, lymphoma and metastasis demonstrate T2 hyperintense signals and meningioma has a tendency to occur in middle aged female patients; therefore excluded. Granuloma occurs in known cases of CNS infective or inflammatory disorders – not compatible to our case. T2-hypointensity of the lesions on MRI is characteristic for deoxyHb, intracellular metHb and hemosiderin⁷. Hemoglobin being a paramagnetic substance, evolves in time from oxyHb, then deoxyHb to metHb converting into ferritin and finally to hemosiderin. Higher concentrations of hemosiderin can cause a strikingly low signal on T2W sequence⁸. The cause of T2 blackout demonstrated in our case is predominantly due to susceptibility effect of these paramagnetic substances⁹. The signal characteristics of the enhancing lesions on MRI signify the presence of cells containing blood/iron products. Extramedullary hematopoiesis (EMH) refers to formation of blood cells occurring outside the medulla of the bone, secondary to insufficient bone marrow function¹⁰. Diagnosis of EMH is based on clinical features, imaging modalities and histopathology. Homayoun Tabesh and his colleagues² reported a case of 34-year-old thalassemic Caucasian man with the complaints of chronic headache whose MRI of his brain revealed a hyperintense lesion on T1W images which was signal void on T2W images in the left trigone area with vivid post contrast enhancement. Koch et al⁵ reported T1W isointense and T2W markedly hypointense intradural mass at posterior interhemispheric fissure showing diffuse enhancement in known hematopoietic disorder with symptoms of weakness, numbness, and hyperreflexia. The signal intensity of these intracranial masses in the above mentioned studies is compatible to our case. All studies including this case provided the evidence that MRI has evolved as the modality of choice in the diagnosis of intracranial EMH. Patients

can directly undergo radiotherapy without suffering from morbidity of surgical biopsy as hematopoietic elements are intensely radiosensitive¹¹. Surgical intervention should be reserved only for uncertain cases⁶. The rare presentation of seizures for intracranial EMH along with multiplicity of the intracranial lesions was unique to our case. This study emphasizes the fact that characteristic T2W, FLAIR and DWI hypointensity of the enhancing masses on sequence is due to magnetic susceptibility effect, caused by accumulation of blood products within tissue, further confirmed by demonstration of high attention soft tissue masses on CT.

CONCLUSION

This case along with literature review highlights the importance of Magnetic Resonance Imaging as the modality of choice for the diagnosis of intracranial extramedullary hematopoiesis - a rare manifestation in known hematopoietic/ myeloproliferative disorder. It is essential for the radiologist to become familiar with the MR features of intracranial EMH for correct diagnosis treatment and prognosis is entirely different from other CNS tumors.

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Mahnoor Hafeez; Study concept and design, protocol writing, data collection, data analysis, manuscript writing, manuscript review

Ateeque Ahmed Khan; data collection, data analysis, manuscript writing, manuscript review