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Case Report

Spontaneous epidural hematoma in a patient with sickle cell anemia - Case report

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Introduction

Sickle cell anemia (SCA) is the most common monogenic multisystemic pathology in the world, affecting approximately 3.2 million people.[1] It is a genetic disease with autosomal recessive inheritance, caused by a mutation in the β-globin gene, in which the nucleobase thymine is changed to adenine, leading to the replacement of glutamic acid for valine at the sixth position in the β-globin chain.[2] This mutation causes structural and functional modifications in erythrocytes, which have their membrane distorted under deoxygenated conditions, leading to vaso-occlusion and extravascular hemolysis.[3]

Vaso-occlusion and hemolysis cause numerous pathological events, which can lead to a wide range of complications. Among the neurological ones, stroke is the most common, affecting around 11 % of SCA patients before the age of 20 years old.[4] Spontaneous epidural hematoma is an extremely rare complication of the disease.[5]

We present a case of a patient with sickle cell anemia and spontaneous epidural hematoma (EDH), emphasizing the difficulty of diagnosis due to the rarity of the event and the benefit of early recognition in the patient's evolution.

Case report

An 11-year-old boy with sickle cell anemia (HbSS) was admitted to the emergency department of Hospital Infantil Darcy Vargas in São Paulo with a history of tonic-clonic seizure. After the seizure, the patient remained drowsy and with dysarthria. A day before the admission, the patient had presented intense leg pain and was treated with painkillers at home. There was no history of head trauma.

On physical examination, the patient was tachycardic, pale, eupneic, afebrile, Glasgow Coma Scale score of 15/15, isocoric and photoreactive pupils, no palpable skull fractures, no focal deficits.

Laboratory tests showed hemoglobin (Hb) of 7.8 g/dL; leukocytes 22,700/mm3, without left shift; platelets 369,000/mm3; reticulocytes 13 % and with normal coagulogram. A CT scan of the skull showed a small hyperdense extra-axial collection located in the right parietal high convexity with no evidence of bone fractures or midline shift.

Twelve hours after the hospital admission, the patient presented fever, decrease of consciousness level (Glasgow Coma Scale score of 12/15), periorbital edema and bilateral proptosis

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of the eyeballs, along with a large subgaleal hematoma that was not present at the admission. New laboratory tests showed worsening anemia with Hb of 4.7 g/dL and decreased platelets, 126,000/mm3. The patient received a transfusion of red blood cells, with a post-transfusion Hb of 8.0 g/dL.

A new CT scan of the skull showed a epidural hematoma in the right frontoparietal high convexity, with 10 mm thickness, pressing the adjacent parenchyma, associated with dense subperiosteal collections near both orbits, two on the right and one on the left, with thicknesses of 11 mm and 10 mm respectively, promoting proptosis of the eyeballs (Figure 1).

Neurosurgical evaluation was requested and magnetic resonance imaging of the skull confirmed the frontoparietal epidural hematomas and extraconal intraorbital hematomas, as well as signs of bone infarction and diffuse heterogeneity of skull's bone marrow. A hypothesis of non-traumatic spontaneous epidural hematoma related to sickle cell anemia was made.

Expectant management was chosen by the neurosurgery team. The patient gradually improved from the epidural and intraorbital hematomas, with partial regression of the ocular proptosis. He remained hospitalized for 15 days, receiving antibiotic therapy due to the initial fever. Two weeks later, the patient returned for an outpatient visit, with complete regression of the hematomas and ocular proptosis.

Discussion

We describe a rare case of EDH in a pre-adolescent with SCA and we found 25 cases reported in the literature in pediatric patients up to 18 years old, with SCA (HbSS), as shown in Table 1.

Since the first report in 1987, the incidence of spontaneous epidural hematoma in children and adolescents has increased dramatically. This does not necessarily reflect a real increase in the number of cases, but rather a radiology advancement and an increased awareness about the subject, since there is greater access to academic content and more opportunities for publication. Nonetheless, even after more than 30 years, there are few reports of spontaneous epidural hematoma in pediatric patients with sickle cell anemia (HbSS).[5]

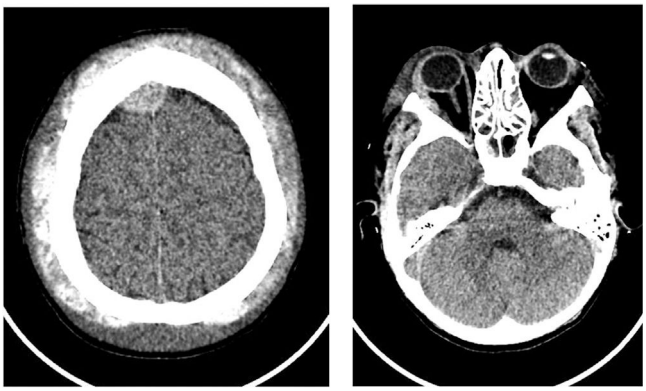

Figure 1 – CT showing an frontoparietal epidural hematoma, extensive subgaleal hematoma and bilateral ocular proptosis.

Most of the reports are from pre-adolescent and adolescent male patients. The most prevalent symptoms at the admission were headache in 39 %, followed by vaso-occlusive crisis in 34 %, and decreased level of consciousness in 13 %. Other reported symptoms included convulsive crisis, periorbital edema, and ocular proptosis. Despite our patient having started with a convulsive crisis, the presence of vaso-occlusive crisis in the lower limbs was reported the day before admission, progressing to periorbital edema and ocular proptosis 12 h after hospitalization, with only two other cases in the literature by *Mallouh* et al.[24] and *Ganesh* et al.[20] reporting this presentation.

The most common locations of the EDH were the frontal and parietal regions, each accounting for 36 %. The predominant laterality was right in 32 % of the hematomas, and bilateral involvement was present in 40 % of the cases. The reported patient presented with a hematoma in the right frontoparietal region, with only one other report in the literature by *Moyen et al.*[11] of a patient with EDH in the same location and laterality.

The pathophysiology of epidural hematoma in patients with sickle cell anemia is not well understood. Around 60 % of the reports identified bony infarcts of the skull in the same area as the hematoma. Therefore, it is speculated that there may be underlying bone vasospasm with periosteal elevation and vessel wall rupture, leading to bleeding into the epidural space.

Dahdaleh et al. elucidated an alternative pathophysiological mechanism, suggesting that chronic extramedullary hematopoiesis, observed in sickle cell disease, contributes to cortical thinning of the skull bones and expansion of the bone marrow. In response to acute anemia, rapid proliferation and expansion of hematopoietic tissue would result in the rupture of cortical vessels, precipitating the extravasation of blood into the epidural space. Finally, insufficient venous drainage would lead to congestion and excessive edema, causing epidural hemorrhage.[25]

We believe that the two mechanisms could have contributed to the EDH in the reported patient, as adjacent bone infarctions were observed alongside the hematoma, and there was a sudden drop in hemoglobin levels. This drop could stimulate extramedullary hematopoiesis, supported by the diffuse heterogeneous appearance of the cranial bone marrow as seen in the cranial MRI.

Another important factor for the etiology of EDH in patients with SCA would be the presence of thrombocytopenia and other coagulopathies. However, the patient's laboratory tests did not reveal such abnormalities.[26] Involvement of the ocular globes is extremely rare in these cases. It is postulated that blood accumulates in the superior orbital ridges, which could disrupt the attachment of the arcus marginalis muscle, leading to the buildup of blood within the orbital cavity. This can result in exophthalmos, decreased vision, and ophthalmoplegia.[27]

Interestingly, the literature shows that patients which were identified bone infarctions had a higher survival rate than those who did not. This event may indicate that vaso-occlusive etiology of the EDH has a better prognosis.

Table 1 – Pediatric cases reported of EDH in association with SCA.

Autor	Year	Age	Sex	Initial sympton	Location	Lateralization	Bone Infarction	Treatment	Outcome
Takromi et al. [30]	2023	14	M	Headache	Frontal	Bilateral	No	Coservative	Survived
Alqurashi et al. [6]	2020	17	M	Headache	Fronto-parietal	Bilateral	No	Conservative	Survived
Kotey et al.[7]	2020	18	M	VOC	Frontal	Left	No	Surgical	Dead
Iversen et al. [8]	2019	18	F	Headache	Fronto-parietal	Left	Yes	Surgical	Survived
Banerjee et al.[9]	2018	Adolescent	M	VOC	Frontal	Left	No	Conservative	Dead
Kumar et al. [10]	2018	9	M	Headache	Parietal	Bilateral	No	Conservative	Survived
Moyen et al.[11]	2018	13	M	Seizure	Fronto-parietal	Right	No	Surgical	Dead
Hann et al. [12]	2016	10	M	VOC	Temporo-parietal	Right	Yes	Surgical	Survived
Hann et al. [12]	2016	10	M	Headache	Parietal	Left	No	Surgical	Survived
Hann et al. [12]	2016	17	M	VOC	Posterior fossa	Bilateral	Yes	Surgical	Survived
Hann et al. [12]	2016	18	M	VOC	Parietal	Right	Yes	Conservative	Survived
Hann et al. [12]	2016	18	M	Headache	Parietal	Bilateral	Yes	Conservative	Survived
Mishra et al. [13]	2017	18	M	VOC	Parietal	Right	Yes	Surgical	Survived
Hettige et al. [14]	2015	7	F	Coma	Parietal	Bilateral	No	Surgical	Dead
Ilhan et al. [15]	2014	15	M	Headache	Frontal	Right	Yes	Conservative	Survived
Page et al. [16]	2014	7	F	Coma	Temporal	Right	Yes	Conservative	Survived
Patra et al. [17]	2012	13	M	Headache	Parietal	Bilateral	Unknown	Surgical	Survived
Babatola et al. [18]	2012	18	M	Headache	Frontal	Right	No	Surgical	Survived
Okito et al. [19]	2004	2	M	Coma	Fronto-temporal	Right	Unknown	Surgical	Dead
Okito et al. [19]	2004	12	F	VOC	Parietal	Left	Yes	Conservative	Survived
Ganesh et al. [20]	2001	11	M	Ocular proptosis	Frontal	Bilateral	Yes	Conservative	Survived
Naran et al. [21]	2000	16	M	Headache	Frontal	Left	No	Conservative	Survived
Cabon et al. [22]	1997	14	F	Unknown	Frontal	Bilateral	Yes	Surgical	Unknown
Resar et al. [23]	1996	14	M	VOC	Frontal and parietal	Bilateral e Left *(resp.)*	Yes	Conservative	Survived
Mallouh et al. [24]	1987	13	M	Periorbital edema	Frontal	Bilateral	Yes	Surgical	Survived

VOC: vaso-occlusive crisis.

Identifying bone infarction can be challenging, and MRI seems to be the most sensitive tool, while CT has low efficacy, especially in the acute phase of the disease.[9]

Management and treatment of EDH depend on the volume, level of consciousness, and hemodynamic status. In the last decades more and more studies reported that the conservative treatment has been chosen for small epidural hematomas. However, this approach requires a close neurological observation and serial CT scanning.[28]

Generally, epidural hematomas less than 30cm3, less than 15 mm in thickness, less than 5 mm midline shift, a Glasgow Coma Scale score greater than 8 and without focal deficit could be managed conservatively. In case of any of these parameters change, the surgical treatment should be considered, due to the risk of herniation.[29]

Among the cases reported in the literature, 45 % were managed conservatively, and 55 % required surgical intervention. It was observed that patients who underwent conservative treatment had a survival rate of 91 %, while those who underwent surgical treatment had a survival rate of 61.5 %. The overall mortality among the cases was 22 %.

Conclusion

This case illustrates a rare neurological complication and emergency of sickle cell anemia in a pediatric patient. We believe that it will elucidate the clinical and pathophysiological aspects of the disease, since it is an important differential diagnosis of other neurological and vaso-occlusive conditions. This case will help in an early recognition of patients with this pathology reducing the risk of deterioration and formulating a care plan based on the patient's evolution.

Conflicts of interest

The authors declare no conflicts of interest.

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