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Early vascular embolization of large orbital and periorbital infantile capillary hemangiomas; A case report

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ABSTRACT

Purpose: Infantile hemangiomas (IH) are the most common benign vascular tumors in childhood. Although they tend to have a benign nature, some hemangiomas may be complicated with astigmatism or deprivation amblyopia. We report a unique case of using an interventional radiological vascular embolization treatment modality for the early management of amblyogenic large right orbital and periorbital infantile capillary hemangiomas.

Observations: After the confirmation of the diagnosis using a magnetic resonance imaging (MRI) of the brain and orbit, and an initial trial of systemic propranolol, an early interventional radiological vascular embolization was done. This was combined with the use of a tapering systemic corticosteroid. The functional and cosmetic outcomes were satisfactory.

Conclusions and Importance: The use of arterial embolization is a promising modality of treatment as a possible alternative or adjunct to medical and surgical treatment cases of IH. To the authors' knowledge, this is one of the rare cases reported in the ophthalmic literature addressing the use of this technique for early management of orbital and periorbital capillary hemangiomas.

1. Introduction

Infantile hemangiomas (IH) are the most common benign vascular tumors in childhood, which may develop in 2.6%–10% of infants by the age of one year.[1] Although they tend to have a benign nature and involute with no major cosmetic after-effects or functional ocular deficits, some hemangiomas may be complicated with astigmatism or deprivation amblyopia.[2,3] Several treatment options exist for IHs, hence, treatment determination depends on multiple factors. Although the first-line treatment for IHs requiring systemic therapy is propranolol and/or corticosteroids,[4] resistance to or failure of these treatments might occur. Thus, selective arterial embolization is a promising treatment modality that could be used as an alternative or adjunct to other treatment modalities of IH. We present a case of a two months-old baby girl who was successfully treated using an arterial embolization technique.

2. Case presentation

This is a case of a two months-old baby girl who is extremely preterm (gestational age of 26 weeks) with an extremely low birth weight (~810 g), and a product of Emergency Cesarean Section (EmCS) with a clear amniotic fluid due to a transverse lie and fetal distress. She is born to a healthy 32 years old lady with no clinical antenatal care or documented ultrasonography. Mother neither received antenatal steroid nor magnesium sulfate. The child's Apgar score was 3,5, and 7 at 1,5 and 10 minutes. Occipital frontal circumference was 23 cm at birth with a body length of 33 cm. Neonatal physical exam at birth including the eyes was not remarkable except of an anal ecchymosis. The child required a neonatal intensive care unit (NICU) admission for four months and was

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intubated at day one of life due to a moderate bronchopulmonary disease and a respiratory distress syndrome. She is fully vaccinated and developmentally up to her age. There was no remarkable family history or consanguinity, and her three siblings are healthy.

She was noticed at day 62 of age to have a right orbital subcutaneous swelling that was increasing in size for 1 week. This was associated with a proptosis, an inability to open her right eye voluntarily, and a presence of a second distinct small facial swelling in the right cheek area (Fig. 1). On examination, the orbital lesion was a diffuse, non-pulsatile, and spongy swelling adherent to the skin of the right upper and lower eyelids. It was mostly prominent in the right lower eyelid with dilated tortuous blood vessels and a bluish discoloration of the overlying skin. The skin was mobile over the surface of the mass with no restricted ocular motility. Pupils were equal in size and reactive to light with no detected relative afferent pupillary defect. Fundoscopic examination showed a stage three, zone three retinopathy of prematurity (ROP) without neovascularization. This was treated with a retinal laser therapy of both eyes at day 85 of age with no sequelae. The facial swelling was localized to the right cheek, and was small (1 × 1 cm), soft, mobile, with no overlying skin changes. It was growing rapidly and misdiagnosed initially as parotitis. Both lesions were not associated with tenderness, redness, hotness, abnormal discharges, bleeding, bruit, or instability of vital signs.

There was no evidence of hyperthyroidism, thrombocytopenia, coagulopathy, or other lesions on abdominal imaging. Inflammatory markers were negative and complete blood count was normal. There were multiple episodes of anemia requiring blood transfusion but without evidence of a high output heart failure. Echocardiogram showed an arterial septal defect secondum, resolved thermodynamically significant patent foramen ovale, and a closed patent ductus arteriosus.

For a definitive diagnosis and further management, a magnetic resonance imaging (MRI) of the brain and orbit (Fig. 2A and B) with IV gadolinium was done at day 71 of age, which showed a large, irregular, well-defined right orbital mass mainly inferior to the right globe, with an extension toward the extra- and intra-conal regions, reaching to the orbital apex and superior orbital fissure, surrounding the inferior rectus muscle and the intra-conal segment of the right optic nerve without an extension to the brain or the cavernous sinus. The lesion measured 1.7 x 1.6 × 3.3 cm in size. The lesion displayed an intermediate-to low-signal intensity on T1-weighted image and a high-signal intensity on T2-weighted image. These features were suggestive of an orbital hemangioma. Additionally, regarding the cheek lesion, an ultrasonography (US) of the parotid area initially showed a right parotid gland mass with multiple hypoechoic masses and increased vascularity. These findings were suggestive of a right cheek hemangioma of the masseter muscle. After one month, a repeated MRI of the brain and orbit confirmed the diagnosis of the right cheek lesion to be hemangioma of the masseter muscle measuring 1.7 × 1.6 cm with similar signal characteristics and enhancement of the orbital lesion. It also showed no change in size of the orbital lesion.

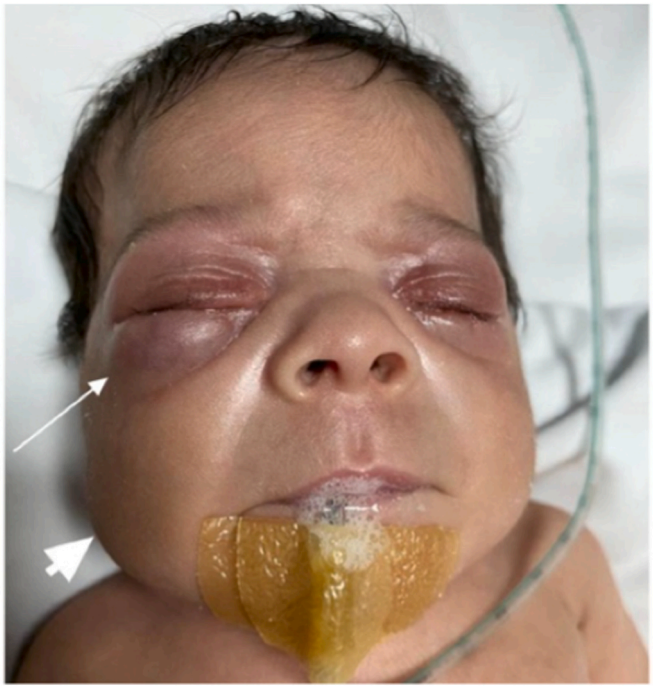

Fig. 1. a 2-month-old baby girl with a right orbital subcutaneous swelling (*Arrow)* and a right facial cheek swelling (*Arrowhead*).

The patient initially, under medical monitoring, was started on propranolol at day 76 of age with a dose of 0.5 mg/kg/day twice a day. Following a normal-for-age baseline electrocardiogram (ECG), the dose was increased gradually to 2 mg/kg/day three times a day as per our institution protocol. Although the patient was not able to open her right eye, minimal, but slow, response in term of decreased lesion size was noticed. Consequently, due to the slow regression, the nature and the anatomical location of the hemangioma which might result in amblyopia or unexpected intracranial bleed, and the difficulty to operate, a multidisciplinary team meeting at day 107 of age was conducted for the management of this individualized case. The team unanimously agreed that an early interventional radiological vascular embolization (IRVE) of feeder vessels would be in the welfare of this patient. Intralesional corticosteroid was not recommended, as it was thought that the risk of precipitating an orbital hemorrhage in an already compromised orbit was too high. Parent were counselled and informed about the therapeutic options, and they agreed on the proposed plan. Thereafter, a cerebral angiography with embolization (Fig. 2C and D) at day 112 of age was done by the interventional radiologists, which was uneventful.

At the day of procedure, she was vitally stable, and her lab work was within normal range. Under general anesthesia, the right femoral artery was percutaneously punctured and an access to the vascular system through a micro-catheter introducer (Merit MAK™) was obtained. Then a Headway DUO microcatheter (Useable length: 156 cm, Proximal/Distal OD: 2.1/1.6 F) was installed in the right femoral artery, and with a guiding catheter, it was navigated into the right external carotid artery. Prior to the actual embolization procedure, sub-selective angiography of the external carotid artery branches using a maximum of 4ml/kg contrast was performed to determine the precise angiographic vascular supply, the dominant feeder's characteristic, and the flow pattern of the lesion. Moreover, a good penetration of the right facial artery (the main supplier) by 1 ml of a liquid embolic material was achieved using a precipitating hydrophobic injectable liquid (PHIL). An obliteration of 70% of the hemangiomal arterial supply was done, except a residual filling via the right ophthalmic artery. Once maximal embolization was reached, we performed angiograms (Fig. 2D), removed the microcatheters, and achieved hemostasis using manual compression of the puncture site in the groin. The day after, a tapering dose of a prednisolone (2mg/kg/day) was started to maximize the effect of embolization. It was tapered as per protocol by 25% every two days until discontinuation.

One week after the intervention, there was a noticeable reduction in the proptosis, lesion size (Fig. 3A), vascularity, and she was finally able to open her right eye. She was discharged home thereafter on propranolol oral therapy maintenance dose. The post-intervention period was uneventful. The functional and cosmetic outcomes were satisfactory (Fig. 3B and C).

Thereafter, the patient had been followed up for one year at monthly intervals. Extraocular muscle movements and fixation, squint angle measurements, cyclorefraction, fundoscopic examination were routinely checked in each visit. No signs of recurrence or increase in lesion size was noted, and all her fundoscopic examinations were normal. Table 1 shows that her astigmatism has been decreasing

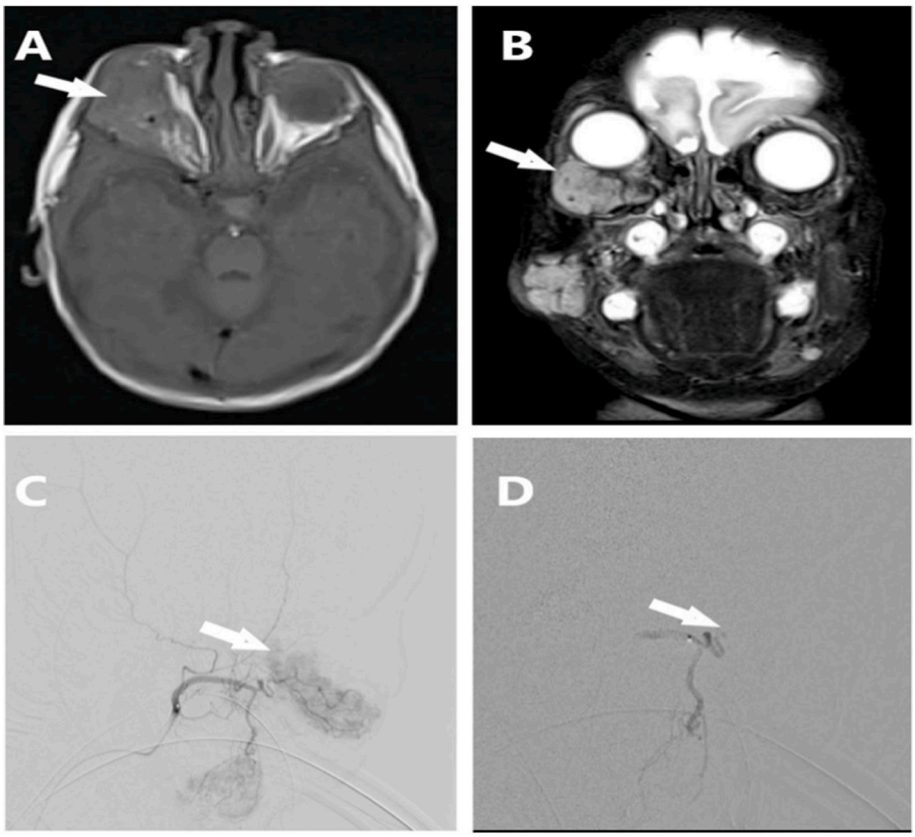

Fig. 2. (**A**) Magnetic resonance imaging (MRI) of the orbit demonstrated lobulated low-signal intensity (*arrow*) tumor on the axial T1-weighted image, (**B**) high-signal intensity on the coronal T2-weighted sequence (*arrow*), conventional diagnostic angiography pre- (**C**) and post-embolization (**D**) of the right facial arterial feeder of hemangioma (*arrow*).

Fig. 3. Week one post-IRVE with opened right eye (**A**). 4 months (**B**) and 12 months (**C**) post-IRVE with noted marked decrease in the lesion size.

Table 1
Post-intervention cyclorefraction follow ups.

Age	Cyclorefraction	
4 months	RE	+2.50 + 3.50 x 90°
	LE	+2.25 + 1.25 x 95°
8 months	RE	+3.00 + 1.75 x 95°
	LE	+3.00 + 0.75 x 90°
12 months	RE	+2.50 + 1.75 x 80°
	LE	+3.00 + 1.25 x 90°

RE: Right eye, **LE:** Left eye.

throughout the visits then stabilizing on the last's visit measurements. She was noted also to have esotropia (ET) at the primary gaze (Fig. 3C) as well as alternating esotropia in cover test (Prism cover test: 25–30 prism diopters).

3. Discussion

Vascular lesions of infants and children are either tumors or vascular malformations based on Mulliken and Glowacki proposed classification of vascular abnormalities.[1] Hemangiomas are considered the most common orbital tumors of childhood. They are either congenital

hemangiomas (CH) or infantile hemangiomas, with the latter being more common, which may develop in 2.6%–10% of infants by the age of one year.[2] Currently, there are no known causative environmental factors or mode of inheritance, although a familial transmission in an autosomal dominant fashion has been reported.[3] Similar to our case, it is recognized that the incidence of hemangiomas is more common in preterm infants, and the most significant risk factor appears to be low birth weight.[4] IH is known to have a female predominance and characterized by a growth phase as defined by a rapid proliferation of blood vessels for approximately 3–6 months, followed by stabilization phase, then an involution phase by the second year of life, where a replacement of the regressed vascular component by a fibrofatty tissue occurs. It completely regresses by the age of seven years in 76% of patients.[5] IHs could be found superficial or deep, small or extensive, with orbital or eyelid involvement, or both. Although they tend to have benign nature and involute with no major cosmetic after-effects or functional ocular deficits, some hemangiomas may cause complications such as ulceration and permanent disfigurement or compromise vital organs' function like the vision compromise occurring in periorbital hemangiomas. This could be attributed to astigmatism or to stimulus-deprivation amblyopia.[5,6] Other complications include proptosis, ptosis, exposure keratopathy, strabismus, optic atrophy, high-output cardiac failure and sepsis due to large ulcerations.[5,6] Any of these complications is an indication for treatment. Although in cutaneous lesions the diagnosis is clinical, US should be used to image the extent of periorbital involvement. If deeper orbital extension is suspected as in our case, then computerized tomography (CT) or MRI might be used.[7] Additionally, angiography is considered one of the accurate methods for evaluating patients with an orbital arteriovenous malformation and vascular lesions.

Several treatment options exist for IHs, hence, treatment determination depends on multiple factors. A prospective study by Haggstrom et al. found that the most important predictors of poor outcomes associated with IHs are large size, segmental morphology, and facial location.[8] Moreover, the most common treatment for IHs is active observation, given the propensity of these lesions to spontaneously regress. Importantly, to shrink the hemangiomas, several treatment modalities have been used with beta-blockers being the first line, which is safer and more effective compared to systemic corticosteroids.[9] Other choices include intra-lesional steroids,[10] chemotherapeutic agents such as interferon,[11] rapamycin kinase (mTOR) inhibitor; sirolimus,[12] laser ablation, sclerosing agents,[13] or surgical resection.[14,15] Although en-bloc and piecemeal resection have been reported to be possible options, these extensive modalities have been avoided as these lesions are difficult to remove due to their unencapsulated nature with potential for marked bleeding and a pronounced postoperative scarring.[16] An alternative, less aggressive, option is vascular embolization.

Embolization with various materials has been used quite often in different fields of medicine. Although propranolol and-or steroid use are currently the most common and first line treatment modalities,[17,18] sometimes they are not successful.[19] Successful selective embolization of non-ophthalmic capillary hemangioma has been reported before.[20,21] A study conducted on 21 infants with large propranolol-resistant infantile parotid hemangiomas (PRIPH) showed that transcatheter arterial sclerosing embolization (TASE) significantly decreased the hemangiomas size with minor side effects during a short follow-up period.[22] Another Chinese study addressed the effective use of TASE combined with corticosteroids in seven cases of PRIPH and achieved satisfactory results.[23]

Very few reports exist on the use of vascular embolization for ophthalmic vascular lesions. One novel study reported a combined interventional, radiologic, and resection technique for the management of a large amblyogenic, highly vascular lower eyelid rapidly involuting CH where preoperative selective embolization and coil placement was done followed by a tumor resection. Endovascular embolization followed by a surgical excision technique was reported to achieve satisfactory cosmetic and functional outcomes in periorbital arteriovenous malformations (AVMs) as well as congenital hemangioma cases.[24–27] In contrast to these reported cases where resection was needed along with embolization, our case was sufficiently controlled with embolization and medical treatment. To our knowledge only one study reported the successful use of a therapeutic embolization for orbital infantile hemangioma.[28] Such an intervention requires a multidisciplinary approach of different sub-specialties, considering the possible complications such as thrombus introduction or formation, inadvertent arterial embolization of normal tissue supply might occur.[28] It behooves the ophthalmologists to realize the availability of this modality of treatment as a possible alternative or adjunct to medical and surgical treatment in handling IH and other orbital vascular lesions.

4. Conclusion

Periorbital hemangiomas must be managed by multidisciplinary diagnostic and therapeutic approaches individualized to each patient. Early intervention might be necessary in selected cases to prevent long-term visual impairment. The use of arterial embolization is a promising modality of treatment as a possible alternative or adjunct to medical and surgical treatment cases of IH.

Credit author statement

Manal Hadrawi: Conceptualization, Supervision, and Validation.

Amer Alghamdi, Ghufran Abudawood and Nourah Alageel: Data curation, Writing, Original draft preparation.

Mawahib Abuauf: Neonatal Period Follow-ups and Documentation, Supervision, and Validation.

Fawaz Alshareef: Interventional Radiological Intervention and Report Writing, Supervision, and Validation.

All authors revised the manuscript critically and gave final approval to submission of the manuscript.

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Patient consent for publication

Written informed consent was obtained from the parents.

Declaration of competing interest

None declared.

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