Interdisciplinary Neurosurgery 16 (2019) 129–131

Contents lists available at ScienceDirect

Interdisciplinary Neurosurgery

journal homepage: www.elsevier.com/locate/inat

Technical Notes & Surgical Techniques

"Micro-introducer access" intra-arterial chemotherapy for retinoblastoma in an 8-week-old infant

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ARTICLE INFO

Keywords:
Retinoblastoma
Intra-arterial chemotherapy
Endovascular
Ophthalmic artery
Pediatrics

ABSTRACT

Intra-arterial chemotherapy (IAC) for retinoblastoma has emerged as a standard therapy to facilitate globe salvage in patients with retinoblastoma. However, transfemoral endovascular catheterization of the ophthalmic artery is typically reserved for infants aged 3 months or older due to size of the patient and vascular anatomy. Here, the authors report a successful case of transfemoral intra-arterial chemotherapy delivery performed for group E retinoblastoma in an infant at 8 weeks of age who weighed only 4.1 kg using "micro-introducer sheath" technique to minimize the size of the arteriotomy. The patient received Melphalan, Topotecan, and Carboplatin via infusion through a microcatheter placed in the right ophthalmic artery. The procedure was tolerated well, and the patient went on to have two additional IAC procedures. Follow-up examinations under anesthesia showed tumor regression in response to chemotherapy. While typically reserved for older and larger patients, with proper technical expertise, transfemoral intra-arterial chemotherapy can be considered in such small infants with highly advanced disease.

1. Introduction

Retinoblastoma affects 1 in 15,000–20,000 livebirths per year and is the most common intraocular malignancy in the first year of life [2,4]. The International Classification for Intraocular Retinoblastoma divides retinoblastoma in categories A–E, with E being the most advanced disease carrying the lowest probability of globe-salvage [5]. Over the past several years, intra-arterial chemotherapy (IAC) has emerged as one of the preferred treatment strategies for retinoblastoma because it is globe-sparing and minimizes exposure to chemotherapy [11]. IAC is, however, technically challenging, and the difficulty of successfully completing the procedure is inversely related to the patient's age and size due to individual vascular anatomy, complicating vascular access and catheter navigation [3].

At our institution, we have adopted a "micro-introducer access" approach to catheterization and angiography to limit the chance of complication in accessing unusually small vessels. Rather than use the standard 4F vascular sheath and guide catheter, we opt for navigating a 0.014″ microcatheter directly through a small micro-introducer sheath placed in the femoral artery without use of a guide catheter.

Few cases of patients < 3 months of age undergoing IAC have been reported in the literature to date [1,6,11]. Of these, none have reported IAC performed in a patient < 3 months old with group E retinoblastoma, nor have they reported IAC in a patient < 4.5 kg [6]. Here, we report a case of an 8-week-old infant diagnosed with group E retinoblastoma who received IAC via a "micro-introducer access" technique without major complication, and with good initial response to chemotherapy.

2. Case report

2.1. History

A 6-week-old male infant presented white reflex which was noticed by his parents. Physical examination confirmed leukocoria. Exam under anesthesia demonstrated diffuse subretinal seeding under total bullous retinal detachment, without vitreous seeds or optic nerve involvement, and no choroidal invasion. Tumor dimensions were 17 × 14 × 13 mm. Patient was diagnosed with Group E retinoblastoma based on tumor size and scheduled for IAC.

The patient underwent IAC at the age of 56 days and weight of 4.1 kg. The procedure was performed under general anesthesia.

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https://doi.org/10.1016/j.inat.2019.01.009
Received 26 October 2018; Accepted 6 January 2019

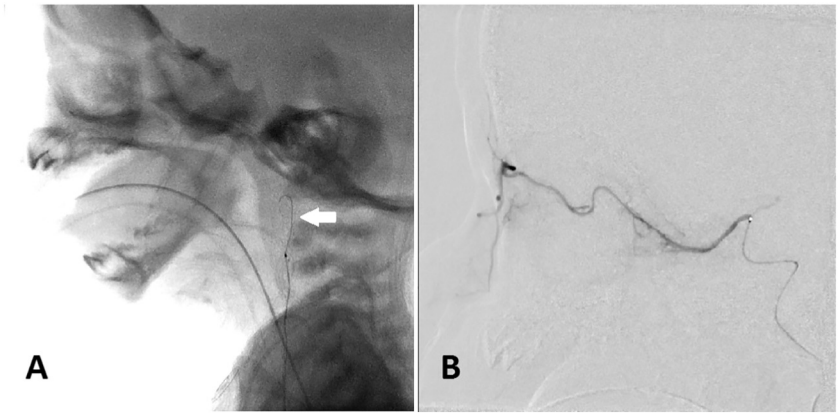

Fig. 1. A) Catheterization of the internal carotid artery by navigation of the Marathon 0.0014″ microcatheter over a shaped Mirage 0.008″ microwire (white arrow). B) Ophthalmic artery injection prior to chemotherapy infusion through the Marathon microcatheter.

2.2. Procedure

A 21-gauge needle was used to cannulate the common femoral artery under ultrasound guidance. A 0.014″ microwire was placed approximately to approximately 8 cm and the needle removed. A 1.3 mm (outer diameter) micro-introducer sheath (Cook Medical, Bloomington, Indiana) was placed over the microwire and the inner dilator and microwire were removed. A previously flushed rotating hemostatic valve (RHV) was then attached to the micro-introducer sheath and the sheath and RHV were secured with adhesive to the infant's groin.

A 0.014″ Marathon microcatheter (Medtronic, Dublin, Ireland) was inserted directly through the RHV and sheath as a guide catheter cannot be placed through the introducer sheath. The microcatheter was navigated over a shaped 0.008″ Mirage microwire (Medtronic, Dublin, Ireland) under fluoroscopy across the aortic arch and into the internal carotid artery (Fig. 1A). Once navigated into the supraclinoid segment, the microwire was removed and the catheter gently retracted to the ostium of the ophthalmic artery. Melphalan 1.9 mg, Topotecan 0.3 mg, and Carboplatin 30 mg were subsequently infused through the microcatheter over 30 min (Fig. 1B). Following delivery of the chemotherapeutic agents, the microcatheter, and micro-introducer sheath were removed and gentle manual compression was used to close the arteriotomy.

Postoperative course: The procedure was well tolerated and the patient was placed on weight-based lovenox for non-occlusive common femoral artery spasm diagnosed after the procedure by ultrasound. Follow-up ultrasound and Doppler showed resolution of femoral artery spasm with no limitations to limb movement or growth. EUA one month later showed tumor regression to a size of 8.6 mm × 7.6 mm × 6 mm. The patient subsequently underwent another "micro-introducer access" IAC and a third IAC, the last time using the standard technique including 4F vascular sheath and guide catheter. A follow-up MRI performed after his most recent IAC showed tumor dimensions of 8 mm × 5 mm × 4 mm. The patient continues to show good response to chemotherapy which bodes well for globe salvage.

3. Discussion

Group E retinoblastoma has a very poor prognosis for globe preservation. Two recent series showed a rate of globe salvage of 36–48% in Group E vs. 91–94% in Group D and 100% in Group C or lower treated with IAC [7,9]. But as recently as 2006, Group E retinoblastoma was uniformly treated by enucleation at major centers [10].

The size of the vascular anatomy of infants < 3 months of age makes IAC a technically challenging procedure [3]. Patients deemed too young or too small for IAC will typically undergo intravenous chemotherapy (IVC), enucleation, or receive IVC for chemoreduction as a bridge to IAC when the patient is older [3]. In recent years, experienced technicians have become more comfortable offering IAC to younger and younger patients [1,6,11]. We propose that modifying the endovascular tools used to perform IAC can broaden the age and size range of patients considered to be safe candidates for the intervention. The risks of operating on such young and small patients must be weighed against the potential benefits. In the case of retinoblastoma in such young infants, avoiding the adverse effects of systemic chemotherapy is an important consideration. IAC carries significant risk of local side effects and vision loss, but in patients with Group E disease vision preservation is unlikely from the outset [8]. Therefore, we elected to perform IAC in an 8-week-old, 4.1 kg infant, to maximize the probability of globe salvage and avoid systemic toxicity of IVC. Our case confirms that with careful patient selection, in expert hands, transfemoral super-selective intra-arterial chemotherapy can be safely considered in young and small infants with advanced disease.

Conflict of interest

The authors have no conflicts of interest to declare.

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