

Staged Transarterial Hemispheric Embolization: An Innovative And Effective Treatment Option For Intractable Seizures In Newborns With Hemimegalencephaly

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Background

Management of the newborn with intractable seizures due to hemimegalencephaly (HME) is challenging. Unrelenting seizures and the multiple anti-seizure medications (ASM) used can impair brain development. Anatomic or functional hemispherectomy is the established treatment for intractable seizures in patients with HME. Delays in surgical treatment appear to be linked to worse developmental outcomes. However, in infants < 3 months of age, surgery can be life threatening from intraoperative blood loss.

Objectives

We present our experience with 5 newborns with HME and intractable seizures who underwent staged targeted transarterial embolization (TAE).

Methods

A multidisciplinary team including a Level 4 Pediatric Epilepsy Program, neonatal ICU, Neonatal Neurocritical Care Service, and an interventional neuroradiology program instituted a staged targeted TAE as the best approach in 5 newborns presenting with HME and intractable seizures between 2013-2018. The region of highest seizure burden was selected for initial and subsequent embolization. During and between embolization, seizure control was maximized with continuous EEG monitoring. Neuroprotective measures to minimize cerebral edema, intracranial bleeding and vasospasm were established.

Results

1 male and 4 females (ages 6-51 days old) with HME and intractable seizures underwent 1-3 staged TAE (per stage mean 3 TAE, range 1-5). Seizure burden improved with each stage; complete seizure resolution was achieved in all 4 survivors prior to NICU discharge. Two patients experienced micro-perforation (1 asymptomatic, 1 fatality). Three were later treated with anatomic (2) or functional (1) hemispherectomy when seizures re-emerged from brain remnants. All survivors remain seizure-controlled on 2-4 ASM. Both newborns who subsequently received anatomic hemispherectomy developed hydrocephalus requiring ventriculo-peritoneal shunt placement.

Conclusion

Staged transarterial hemispheric embolization for HME is an effective alternate treatment option for the management of intractable seizures in the newborn. Long term neurodevelopmental outcome assessments are underway.

References: (1) Jonas et al 2004; (2) Honda et al 2013; (3) Moosa et al 2013; (4) Ouligbo et al 2016.

Table 1: Patient Demographics

Patient	Gestational Age (weeks)	Gender	Birth Wgt (kg)	HME	Isolated HME	Age at First Stage	No of Stages	Number of Embolizations		
								Stage #1	Stage #2	Stage #3
#1	38w5d	M	3.14	Left	No	23d	3	MCA	PCA	ACA, MCA
#2	34w5d	F	2.58	Left	No; FH ID	49d	3	MCA	MCA, PCA	ACA
#3	39w4d	F	4.32	Left	Yes	43d	1	PCA, MCA		
#4	39w0d	F	3.07	Right	Yes	11d	1	MCA, ACA		
#5	39w1d	F	3.42	Left	Yes	14d	3	MCA, PCA	PCA, ACA	ACA

Figure 1: Patient #5 anatomic & perfusion MR images and unsubtracted angiographic images

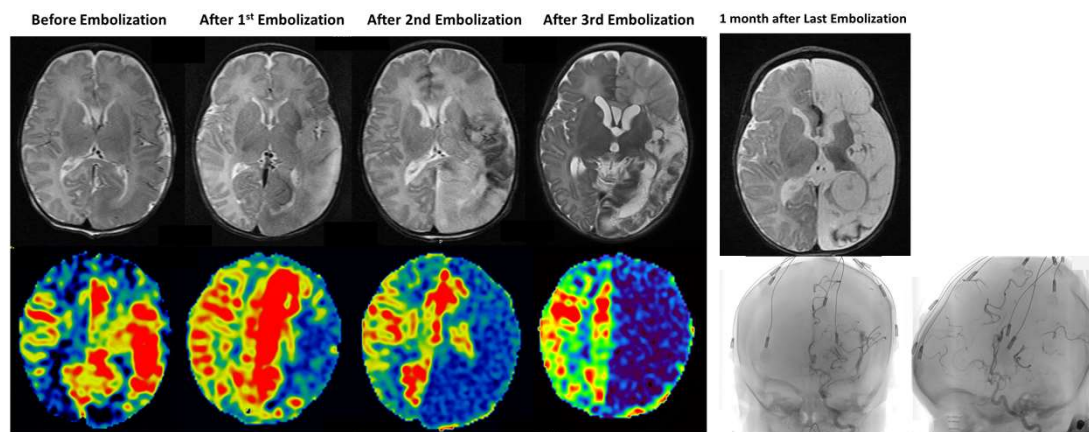


Table 2: Neurodevelopmental Outcomes

Patient	Current Age	Mortality	Hemispherectomy Anatomic / Functional	Shunt	Feeding	Mobility	Language	ASM	Seizures
#1	5y		Anatomic	Y	Gtube	Wheel chair	< 20 words	LTG, CLB, OXC, TPM	Yes
#2	5y		Anatomic	Y	Mostly Gtube	Gait trainer	> 50 words	LTG, TPM, LEV, KLN	Yes
#3	2y		Functional	N	Oral	Gait trainer	1-2 word sentences	OXC, ZNG, LEV	Few, minor
#4		Yes							
#5	1y		NTD	N	Gtube & Oral	n/a	3-5 words	VGB, OXC, LEV	None