



Contents lists available at ScienceDirect

American Journal of Emergency Medicine

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

Case Report

Acute pediatric stroke—what's the hurry? A case for emergency physician-performed echocardiography[☆]

Abstract

Acute ischemic stroke in a pediatric population is uncommon and has a different etiology from the adult population. We describe a case of acute ischemic stroke for which emergent, physician-sonographer-performed transthoracic echocardiography (TTE) changed his outcome. The patient in this case presented with left-sided hemiparesis, with subsequent CT Angiography (CTA) imaging and follow-on neurosurgical embolectomy for a proximal middle cerebral artery occlusion after which showed early recovery of muscular deficit. The cause ultimately was from an atrial myxoma that was identified early by emergency physician-performed TTE and led to early resection possibly preventing recurrence of stroke.

Emergency physician-sonographer (EPS)-performed transthoracic echocardiography (TTE) point-of-care ultrasound (POCUS) has gained acceptance in the last decade for evaluating for potential acute cardiac catastrophe. Although other organ system ultrasounds are standard practice for emergency physicians evaluating trauma, shock, aorta, deep venous thrombosis, and gaining vascular access, however, EPS continue to push the limits of emergent, cardiac ultrasound to improve patient outcomes. We present a case report demonstrating the ease of EPS-performed TTE POCUS for early diagnosis of embolic stroke in a pediatric population.

An 11-year-old previously healthy boy presented to the emergency department (ED) by air transport with acute onset of left-sided hemiparesis 1 hour before arrival. The patient was leaving a soccer field and suddenly collapsed. His family witnessed his sudden hemiparesis and associated nausea and headache.

His ED examination was remarkable for complete left-sided flaccid paralysis as well as inducible, left ankle clonus on dorsiflexion, left-sided gaze preference. His remaining physical examination was unremarkable with age-appropriate vital signs.

The patient had an emergent computed tomography (CT), and a stroke alert was activated. The initial noncontrast head CT was unremarkable, but with the short duration and the clear time of onset, the decision was made to perform a CTA of head and neck. This revealed a complete occlusion of the proximal right M1 branch of the middle cerebral artery (Fig. 1). Neurosurgery was consulted, and he was taken emergently for diagnostic angiography. Interventional embolectomy was performed and recovered a fatty, “grape cluster-appearing” mass.

Upon arrival to the Pediatric Intensive Care Unit (PICU) postoperatively, the patient was showing evidence of neurologic recovery of strength in the left arm and leg. During his examination, he had evidence of a reticuloform rash (Fig. 2) on his distal limbs as well as

splinter hemorrhages on his nail beds. Notably, he had a normal cardiac examination without evidence of any murmurs, rubs, or gallops classically associated with myxoma. His family did not recall any recent infections, intravenous access, fractures or trauma, and family history of coagulopathy. The patient had recently been evaluated by 2 outpatient specialists for the rash that was deemed a benign rash.

The patient had an EPS-performed TTE that showed a left atrial, pedunculated mass with evidence of intermittent but complete mitral valve diastolic prolapse and obstruction as well as loosely adherent fragments to the mass. Cardiothoracic surgery was consulted. Patient had complete TTE performed preoperatively with supporting evidence for atrial myxoma (Fig. 3 and Video). The patient had surgery, and the mass was resected from the left side of the interatrial septal wall. Surgically obtained pathology specimen confirmed atrial myxoma (Fig. 4).

The patient recovered well in the PICU with improvement to 4 of 5 strength in his left arm and leg and was subsequently transferred to an outpatient recovery facility. His family was screened for atrial myxoma without any primary relatives with similar mass.



Fig. 1. Arrow marking the proximal right M1 branch arterial occlusion.

[☆] Competing interests: None.



Fig. 2. Reticuloform rash on the patient's left foot. This rash intermittently appeared on different body parts with associated paresthesia or weakness during the preceding 4 months. Each episode spontaneously resolved within a few hours.

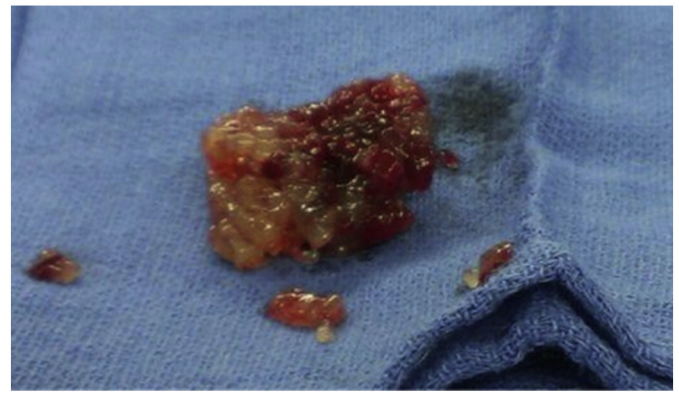


Fig. 4. Excised left atrial mass. Final pathology determined the mass to be an irregularly shaped 15-g mass measuring $4.4 \times 3.5 \times 2.8$ cm with a 1.1-cm stalk. A similarly characterized mass was retrieved during endovascular thrombectomy by neurosurgery.

The differential diagnosis and evaluation of acute stroke in the pediatric population should be based in the understanding that the probability of a nonatherosclerotic etiology is much higher than in the adult population. Other common etiologies seen are cerebral arterial pathologies (79% in one study), underlying cardiac disease (25% in the Canadian Pediatric Stroke Registry), postvaricella arteriopathy, sickle cell anemia related, moyamoya, and hematologic factors such as antiphospholipid antibodies and hyperhomocysteinemia [1-4]. The percentage of cases related to arterial dissection of the carotid or vertebral arteries has been estimated between 7% and 20% in the pediatric population [1]. In addition, one study showed that the vast majority of these dissections occurred in the cervical area and were not intracranial in location [2]. Given that our patient was playing soccer when this occurred, this was strongly considered during the initial evaluation.

Cardiac myxoma has been implicated in acute ischemic stroke and has been identified by practitioners using bedside echocardiography

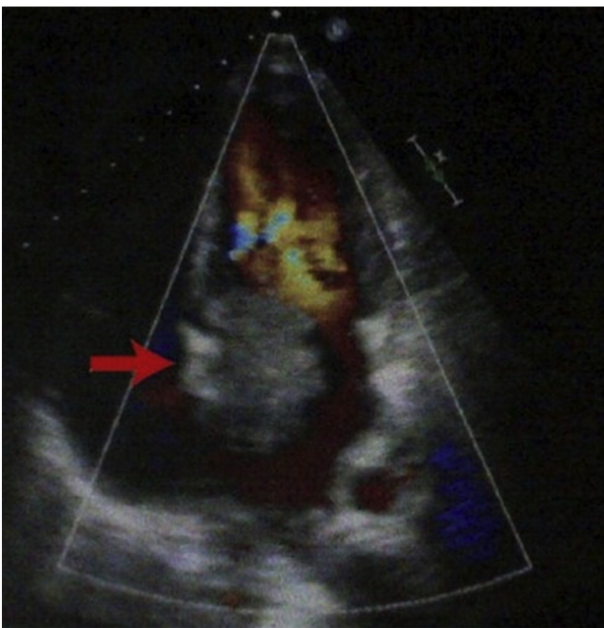


Fig. 3. Transthoracic echocardiography demonstrating partially obstructive mitral valve mass. On color flow Doppler, the patient had intermittent severe mitral stenosis. The mass was mobile and attached by a short stalk at the interatrial septum.

with this being the diagnostic test of choice [5]. Several case reports have provided examples of the identification of atrial masses by bedside TTE. One such report involved a patient with recurrent, unexplained pulmonary edema with normal cardiac silhouette on chest radiograph who was awaiting cardiology follow-up. He presented to ED with pulmonary edema, a bedside TTE was performed, and a left atrial myxoma was found [6]. Another case report describes the acute onset of seizure in an elderly woman, who was then also noted to have atrial fibrillation with bradycardia and a loud systolic murmur on examination. A bedside ultrasound was performed, which revealed a left atrial mass found to be myxoma [7]. The spectrum of presentation from atrial myxoma can be quite broad and involve cardiac obstructive effects, embolic phenomenon, and constitutional symptoms. Of 112 cases of atrial myxoma, one review showed that 67% of patients demonstrated cardiac manifestations (ie, cardiac failure and syncope), 20% presented with fevers, and 29% had embolic presentations (21% with cerebral embolic disease) [8]. Another study evaluated cases of cardiac myxomas that led to neurologic manifestations and reported that of those, 82% had an ischemic stroke or transient ischemic attack, 16% had intracranial hemorrhage, and 23% had a psychiatric manifestation [9].

Pediatric ischemic stroke is a rare entity; however, with a high mortality and morbidity with rates as high as 20% to 50% [9], early identification is necessary. Although a rhabdomyoma is the most common cardiac mass, atrial myxoma is more likely to embolize because of the friable, pedunculated segments. The presenting symptoms for all-comers with embolic, atrial myxoma are vague constitutional symptoms with nearly 2 of 3 of pediatric patients having new-onset congestive heart failure or severe respiratory failure [10]. In a literature review of the 16 reported cases of pediatric ischemic stroke with embolic stroke, 6 of 16 had delayed magnetic resonance imaging as the initial imaging modality, with a further 5 of 16 having CT, 3 of 16 having angiography, and 2 of 16 did not have any imaging. Identification and subsequent treatment of the myxoma for source control were variables in all cases [11-20]. Physical examination as well as known rarity of the presentation in this age group was key to prompting an emergent EPS POCUS TTE in this case [21].

Our case demonstrates the importance of keeping a broad and appropriate differential for pediatric patients who present with acute ischemic stroke and emphasizes the importance of early vascular imaging in appropriate cases. Given its ease and efficiency, early EPS-performed TTE POCUS may be particularly useful in unexplained cases of seizure, stroke, or other acute cardiac or neurologic presentations and can serve to guide therapy at a very early juncture as in this patient's clinical course. This patient had a potentially devastating embolic stroke with life-changing outcomes had the mass not been identified in the ED. His EPS-performed TTE showed evidence of a

friable myxoma with potential for recurrent strokes had the TTE been delayed until after admission [22,23,24,25].

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.ajem.2014.04.023>.

Acknowledgment

We thank Karianne Sparks and Lindsey Solovey, RDMS for manuscript preparation.

Christopher D. Thom MD

Department of Emergency Medicine

Thomas Jefferson University, Philadelphia, PA

Department of Emergency Medicine

Virginia Commonwealth University Health System, Richmond, VA

Scott E. Sparks MD, RDMS, RDCS

Department of Emergency Medicine

Virginia Commonwealth University Health System, Richmond, VA

Department of Emergency Medicine, Emergency Ultrasound Section

St. Luke's University Health Network, Bethlehem, PA

E-mail address: scott.sparks@sluhn.org

<http://dx.doi.org/10.1016/j.ajem.2014.04.023>

References

- [1] Bernard T, Goldenberg N. Pediatric arterial ischemic stroke. *Hematol Oncol Clin North Am* 2010;24:167–80.
- [2] Ganesan V, Prengler M, McShane M, Wade A, Kirkham F. Investigation of risk factors in children with arterial ischemic stroke. *Ann Neurol* 2003;53:167–73.
- [3] MacKay MT, Wiznitzer M, Benedict SL, Lee KJ, DeVeber GA, Ganesan V, et al. On behalf of the International Pediatric Stroke Study Group, Arterial Ischemic Stroke Risk Factors: The International Pediatric Stroke Study. *Ann Neuro* 2011;69:130–40.
- [4] DeVeber G. Risk factors for childhood stroke: little folks have different strokes! *Ann Neurol* 2003;53:149–50.
- [5] Briassouli G, Kuburovic V, Xekouki P, Patronas N, Keil MF, Lyssikatos C, et al. Recurrent left atrial myxomas in carney complex: a genetic cause of multiple strokes that can be prevented. *J Stroke Cerebrovasc Dis* 2012;21:914.e1–8.
- [6] Dioszeghy C, Kamaras G, Frigyi A. Primary cardiac tumor identified as the cause of seizure. *West J Emerg Med* 2011;1:84–6.
- [7] Pinede L, Duhaut P, Loire R. Clinical presentation of left atrial cardiac myxoma. A series of 112 consecutive cases. *Medicine* 2001;80:159–72.
- [8] Ekinci EI, Donnan GA. Neurological manifestations of cardiac myxoma: a review of the literature and report of cases. *Intern Med J* 2004;34:243–9.
- [9] Roach ES, Golomb MR, Adams R, Biller J, Daniels S, DeVeber G, et al. Management of stroke in infants and children: a scientific statement from a special writing group of the American Heart Association Stroke Council and the Council on Cardiovascular Disease in the Young. *Stroke* 2008;39:2644–91.
- [10] Ruiz Pérez L, Sempere Pérez A, García Alonso A, Alenda González C, Flores Serrano J. Cerebrovascular stroke as a sign of atrial myxoma in childhood. *An Pediatr (Barc)* 2003;58:273–6.
- [11] Al-Mateen M, Hood M, Trippel D, Samuel JI, Otto RK, Vitikainen KJ. Cerebral embolism from atrial myxoma in pediatric patients. *Pediatrics* 2003;112:e162–7.
- [12] Bayir H, Morelli PJ, Smith TH, Biancianiello TA. A left atrial myxoma presenting as a cerebrovascular accident. *Pediatr Neurol* 1999;21:569–72.
- [13] Ghosh A, Bhattacharyya A, Niyogi P. Recurrent left atrial myxoma with recurrent stroke. *Indian Pediatr* 2001;38:1190–2.
- [14] Tipton BK, Robertson JT, Robertson JH. Embolism to the central nervous system from cardiac myxoma: report of two cases. *J Neurol* 1977;47:927–40.
- [15] Bobo H, Evans OB. Intracranial aneurysms in a child with recurrent atrial myxoma. *Pediatr Neurol* 1987;3:230–2.
- [16] Tonz M, Laske A, Carnel T, da Silva V, F Real, Turina M, et al. Convulsions, hemiparesis and central retinal artery occlusion due to left atrial myxoma in a child. *Eur J Pediatr* 1992;151:652–4.
- [17] Hung PC, Wang HS, Chou ML, Huang SC, Su WJ, et al. Multiple cerebral aneurysms in a child with cardiac myxoma. *J Formos Med Assoc* 1992;91:818–21.
- [18] Goldberg HP, Glenn F, Dotter CT, Steinberg I. Myxoma of the left atrium: diagnosis made during life with operative and post-mortem findings. *Circulation* 1952;6:762–7.
- [19] Landes C, Baumann R, Coffrill CM. Embolic strokes in an 8-year-old girl. *Neurology* 2000;55:146.
- [20] Sernich S, Chauhan A, Singh D, Fuchs H, Caspi J. Left atrial myxoma in a child: a challenging diagnosis of a rare lesion. *World J Pediatr Congenit Heart Surg* 2013;4:220–2.
- [21] Rao R, Prashanth P, Mukhaini M. A large left atrial myxoma detected in emergency department using bedside transthoracic echocardiography. *J Emerg Trauma Shock* 2011;4:518–20.
- [22] Pridie R. Left atrial myxomas in childhood: presentation with emboli—diagnosis by ultrasonics. *Thorax* 1972;27:759–63.
- [23] Beanlands D, Dolan D, Shane S. Myxoma of the left atrium—case report. *CMAJ* 1960;83:715–7.
- [24] Paladino MA, Basso C, Moreolo GS, Thiene G, Stellin G. Left atrial myxoma in a child: case report and review of the literature. *Cardiovasc Pathol* 2003;12:233–6.
- [25] Mahar LJ, Lie JT, Groover RV, Seward JB, Puga FJ, Feldt RH, et al. Primary cardiac myxosarcoma in a child. *Mayo Clin Proc* 1970;54:261–6.