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Original Article

A Multispecialty Pediatric Neurovascular Conference: A Model for Interdisciplinary Management of Complex Disease

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ABSTRACT

INTRODUCTION: In 2013, our institution established a multidisciplinary pediatric neurovascular conference for coordination of care. Here, we review our initial experience. **METHODS:** Clinical and demographic data were obtained from medical records for patients presented to the pediatric neurovascular conference from April 2013 to July 2014. Patient descriptive characteristics were described by mean and standard deviation for continuous measures and by number and percent for categorical measures. Patients were secondarily stratified by lesion/disease type, and descriptive statistics were used to measure demographic and clinical variables. **RESULTS:** The pediatric neurovascular conference met 26 times in the study period. Overall, 75 children were presented to the conference over a 15-month period. The mean age was 9.8 (standard deviation, 6.3) years. There were 42 (56%) male patients. These 75 children were presented a total of 112 times. There were 28 (37%) patients with history of stroke. Complex vascular lesions were the most frequently discussed entity; of 62 children (83%) with a diagnosed vascular lesion, brain arteriovenous malformation (29%), cavernous malformation (15%), and moyamoya (11%) were most common. Most discussions were for review of imaging (35%), treatment plan formulation (27%), the need for additional imaging (25%), or diagnosis (13%). Standardized care protocols for arteriovenous malformation and moyamoya were developed. **CONCLUSION:** A multidisciplinary conference among a diverse group of providers guides complex care decisions, helps standardize care protocols, promotes provider collaboration, and supports continuity of care in pediatric neurovascular disease.

Keywords: pediatric stroke, arteriovenous malformation, moyamoya, cavernous malformation, multidisciplinary

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Introduction

Pediatric neurovascular diseases are uncommon and heterogeneous in nature. With the exception of stroke, there are no evidence-based management guidelines available for these conditions in children.[1-3] Care is simply based on extrapolation of the adult literature,

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TABLE 1.
Rare Diseases With or Predisposing to Neurovascular Abnormalities

Category	Disease (Vascular Lesion)
Genetic	• Autosomal dominant polycystic kidney disease (aneurysm) • Hereditary hemorrhagic telangiectasia (AVM, aneurysm) • Multiple cerebral cavernoma genes (CCM1, CCM2, CCM3) • Sickle cell disease (moyamoya) • Neurofibromatosis type I (moyamoya) • PHACE syndrome (moyamoya and arterial dysplasia) • Down syndrome (moyamoya) • Loeys-Dietz syndrome (arterial tortuosity and aneurysm)
Connective tissue disorders	• Fibromuscular dysplasia (aneurysm) • Ehlers-Danlos type IV (aneurysm) • Pseudoxanthoma elasticum (aneurysm)
Rheumatological	• Takayasu arteritis (aneurysm) • Polyarteritis nodosa (aneurysm) • Behcet disease (aneurysm) • Kawasaki disease (aneurysm) • Systemic lupus erythematosus (vasculitis)
Other	• Idiopathic moyamoya disease • Coarctation of the aorta (aneurysm) • Sturge-Weber syndrome (cerebral angioma)

Abbreviations:
AVM = Arteriovenous malformation
PHACE = Posterior fossa malformations, hemangioma, arterial lesions, cardiac abnormalities, and eye abnormalities

when applicable, and on expert opinion. Many of these conditions are found in children with rare diseases that may predispose them to neurovascular abnormalities[4-9] (Table 1).

Given the paucity of guidelines for pediatric neurovascular disease management, in 2013, our institution established a multispecialty pediatric neurovascular conference (PNVC) to address complex cases that we believed would benefit from a coordinated, multidisciplinary approach to patient care. Our objective was to create a collaborative forum where providers could meet to discuss cases, review diagnoses and imaging, and develop joint management plans at no cost to the patient.

The PNVC is composed of attending physicians and nurse practitioners representing seven specialties: pediatric neurology, pediatric neurosurgery, neurointerventional (endovascular) surgery, anesthesiology, neuroradiology, radiation oncology, and pediatric critical care. The PNVC is held every 2 weeks, and trainees are invited to attend as well. Cases of known or suspected neurovascular lesions are submitted by participants for discussion.

Here, we review our initial experience and examine how the PNVC has helped foster multispecialty collaboration and coordinated care protocols for pediatric neurovascular disease management.

Methods

Study procedure

A record of patients presented to the PNVC was established in April 2013 and prospectively populated for quality assurance. After institutional review board approval, clinical records for these listed patients presented from April 2013 to July 2014 were retrospectively reviewed. Demographic variables (age, sex, and race/ethnicity) and clinical variables (presenting symptoms, stroke history, diagnosis, neuroimaging, and all interventions) were collected. PNVC records were reviewed to determine reason for referral to PNVC and clinical decisions after PNVC discussion.

A seven-item survey regarding usefulness of the PNVC was developed and administered to PNVC participants (all of whom are co-authors on this report) for quality improvement purposes. The survey was administered by the senior author, who did not complete a survey. Respondent specialty was collected. Items #1-6 were scored on a 5-point Likert scale, with choices ranging from "strongly agree" = 5 to "strongly disagree" = 1. Item #7 was a four-option multiple-choice question regarding what the respondent felt was the most useful aspect of PNVC.

Data analysis

Statistical analyses were computed using Microsoft Excel 2011 (Microsoft Corp, Bellevue, WA). Patient descriptive characteristics were described by mean and standard deviation for continuous measures and by number and percent for categorical measures. Patients were secondarily stratified by lesion/disease type, and descriptive statistics were used to measure demographic and clinical variables.

Results

Patient population

Overall, 75 children were presented to the PNVC over a 15-month period. The mean age was 9.8 (standard deviation, 6.3) years. There were 42 (56%) males. There were 53 (71%) caucasian, non-hispanic/latino; 14 (19%) African-American, non-hispanic/latino; and 8 (11%) caucasian, hispanic/latino patients. Headache (21 of 75, 28%), seizure (15 of 75, 20%), altered mental status/loss of consciousness (10 of 75, 13%), and focal weakness (9 of 75, 12%) were the most common presenting symptoms. Twenty-eight (37%) children had a history of stroke, 15 of 75 (20%) hemorrhagic and 13 of 75 (17%) ischemic. Of 62 children (83%) with a diagnosed vascular lesion, arteriovenous malformation (AVM; 18 of 62, 29%), cavernous malformation (9 of 62, 15%), and moyamoya (7 of 62, 11%) were most common (Table 2).

Initial PNVC discussions

The PNVC met 26 times in the study period. Seventy-five children were presented a total of 112 times. Initial discussions were primarily for review of imaging (26 of 75, 35%), treatment plan (20 of 75, 27%), need for additional imaging (19 of 75, 25%), or diagnosis (10 of 75, 13%; Table 3). Discussion of treatment plan was more common in AVM (10 of 18, 55%) and large vessel occlusion or dissection (3 of 6, 50%). Review of imaging was a common reason for moyamoya (6 of 7, 86%) and aneurysm (3 of 5, 60%) cases. For cases where there was a concern for vascular lesion on MRI (n = 4), concern for an infectious aneurysm (n = 3) or another uncategorized vascular lesion (n = 9), need for additional vascular imaging was the primary question in 6 of 16 (38%) cases. Forty-two (56%) patients had a magnetic resonance imaging (MRI)/magnetic resonance angiography (MRA), and 10 (13%) patients had a computed tomography angiography after discussion at PNVC.

Interventions for 75 patients

Follow-up conventional angiography was performed in 18 of 75 (24%) cases, particularly for AVM (9 of 18, 50%) and aneurysm (3 of 5, 60%; Table 3). A diagnostic catheter