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Original Article

Manifestations of Pediatric Intracranial Hypertension From the Intracranial Hypertension Registry

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ABSTRACT

OBJECTIVE: The purpose of this study was to examine the presenting symptoms, demographics, and interventions in pediatric patients enrolled in the Intracranial Hypertension Registry. **METHODS:** We analyzed confirmed intracranial hypertension patients ≤18 years at the time of initial diagnosis who were enrolled in the registry. **RESULTS:** A total of 203 patients met the criteria for inclusion; 142 (70%) were considered primary intracranial hypertension. Females made up 72.5% (103 of 142) and 75.8% (47 of 61) in the primary intracranial hypertension and secondary intracranial hypertension groups, respectively. There were no clinically significant differences in age, body mass index, or opening pressure between the primary intracranial hypertension and secondary intracranial hypertension groups. Symptoms most often reported were headache and blurred vision. Bilateral optic disc edema occurred in 89.3% of primary intracranial hypertension and 78.7% of secondary intracranial hypertension patients. When divided into pre- and postpubertal status, 32.5% of patients were classified prepubertal; 77.3% of these had primary intracranial hypertension. This resulted in a female to male ratio of 1:1.04 for prepubertal and 6:1 for postpubertal primary intracranial hypertension patients. The body mass index was significantly higher in the postpubertal primary intracranial hypertension group ($P = 0.0014$). There was no significant difference in opening pressure. **CONCLUSIONS:** The common symptoms of intracranial hypertension, including headache, optic disc edema, and vision changes, occurred with similar frequencies in our cohort to those reported in the literature. In separate subanalyses, we found significantly higher rates of obesity in postpubertal females with primary intracranial hypertension. The female-to-male ratios in the postpubertal primary intracranial hypertension and secondary intracranial hypertension groups were higher than reported in the literature.

Keywords: idiopathic intracranial hypertension, pseudotumor cerebri, pediatric, pseudotumor cerebri

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Introduction

Primary intracranial hypertension (PIH; idiopathic intracranial hypertension, pseudotumor cerebri) has been considered rare. Although the annual incidence in the United States is estimated at 0.9 per 100,000, there are no good estimates in the pediatric population.[1] In Germany the annual pediatric incidence is 0.5 per 100,000 and, in Croatia, 1.2 per 100,000.[2,3]

The Intracranial Hypertension Research Foundation (henceforth the Foundation) began in 2001 as a nonprofit organization in Vancouver, Washington to support research on this condition. The Foundation, in partnership with the Casey Eye Institute at Oregon Health and Science University, formed the Intracranial Hypertension Registry (the Registry) in 2003 as an initial step to promote research. The Registry is a physician-controlled project that invites and collaborates with outside researchers wishing to use

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Registry data. Periodically, the Foundation hosts informational patient conferences with physician and research speakers. The Registry is comprised of intracranial hypertension patients who enrolled by completing an entry questionnaire and agreeing to collection of their medical records and annual follow-up reporting. Patients of any age are accepted after their records are reviewed to confirm the diagnosis of intracranial hypertension.

The purpose of this study was to examine the presenting symptoms, demographics, and interventions in pediatric patients enrolled in the Registry.

Materials and Methods

Institutional Review Board for Human Research of Nationwide Children's Hospital approved the study. We analyzed aggregated de-identified Registry data from individuals who were 18-years-old or less at the time of initial diagnosis.

The Registry is made up of individuals who were largely self-referred to the Registry after being diagnosed with intracranial hypertension. After initial contact from the patient or patient provider, releases are signed and the patient's medical records are gathered. Requested documents include their primary healthcare records, neurological and ophthalmologic clinic records as well as any associated surgical information, imaging studies, and laboratory results. Regardless of the patient's age, Modified Dandy Criteria are to determine eligibility for inclusion in the Registry.[4] Those without a diagnostic opening pressure listed in the records all had subsequent elevated opening pressures that met the criteria.

Approximately one third of referred patients are not enrolled in the Registry database after record review because of incomplete records or lack of documentation to support the diagnosis of intracranial hypertension. Pediatric patients make up approximately 14% of the Registry participants. Patients from the United States make up a majority of patients from the 37 countries represented in the Registry.

Results

A total of 203 individuals aged 18 years or less met the criteria for inclusion in the analysis: 142 (70%) were classified as PIH and the remaining 61 as secondary intracranial hypertension (SIH). Females made up 72.5% (103 of 142) and 75.4% (46 of 61) in the PIH and SIH groups, respectively (Table 1). The ethnic composition between the groups was 90.9% and 91.8% Caucasian, 3.5% and 1.6% African-American, 2.8% and 1.6% Hispanic, and 2.8% and 4.9% other for PIH and SIH, respectively. Neither cohort contained individuals of native American or indigenous Alaskan heritage. Four patients (2.8%) with PIH had a confirmed family member with PIH; none had a relative with SIH. In the SIH group, one patient (1.6%) had a family member with PIH, and three (4.8%) had a family member with SIH. In both groups, these were two mothers of offspring and two sibling relationships. The most common reasons for patients to be listed as SIH included use of the tetracycline class of medications (tetracycline, minocycline and doxycycline) in 36.1% (22 of 61), Chiari malformation in 18% (11 of 61), and prior meningitis in 13.1% (8 of 61; Table 2).

Clinical presentation

Patients most often reported headache (96.5% PIH, 98.4% SIH) and blurred vision (71.2% PIH, 70.5% SIH; Table 3). Optic disc edema was noted in 87.1% (175 of 201, two PIH patients were unknown) of patients, of which 90% (126 of 140) were PIH and 80.3% (49 of 61) were SIH. Bilateral optic disc edema occurred in 89.3% (125 of 140) of PIH patients and 78.7% (48 of 61) of SIH patients. Unilateral optic disc edema occurred in 0.7% (1 of 140) of PIH patients and 1.6% (1 of 61) of SIH patients. Average age at the time of diagnosis was 12.42 and 13.15 years for PIH and SIH patients, respectively; there was no significant difference between the two groups ($P = 0.264$). Height and weight measurements were available for 113 PIH and 48 SIH patients at the time of diagnosis allowing calculations of mean body mass index (BMI) that were identical at 27.2.

The initial diagnostic opening pressure was recorded in 132 PIH and 53 SIH patients. The mean was 33.5 cm H_20 for PIH with 15 excluded (14 exceeded the manometer's measuring capability and one was recorded as a range). In the SIH patients, the mean was 36.4 cm H_20 with nine

TABLE 1.
Patient Demographics

	PIH	SIH	*P* Value
Number	142	61	
Female	72.5% (103)	75.8% (47)	
Female: male	2.6:1	3.1:1	
Average age (years)	12.4	13.12	0.264
Standard deviation	4.4	4.2	
Range	1.3-18.8	2.3-18.9	
Race			
Caucasian	90.8% (129)	91.9% (57)	
African-American	3.5% (5)	1.6% (1)	
Hispanic	2.8% (4)	1.6% (1)	
Other	2.8% (4)	4.8% (3)	
Body mass index	113/142	48/61	
Mean	27.2	27.2	
Standard deviation	9.1	8	
Range	13.2-53.9	11.1-44.6	
Opening pressure*	117/142	45/61	
Mean pressure*	33.5	36.2	0.122
Standard deviation	9.7	10.9	
Range	15-58	17-69	
Other medical problems			
Migraine	8.5% (12)	6.5% (4)	
Obesity	9.9% (14)	1.6% (1)	
PCOS	5.6% (8)	8.1% (5)	
Anxiety/depression	0	0	
Family member with IH			
PIH	2.8% (4)	1.6% (1)	
SIH	0	4.8% (3)	
Cranial imaging	142/142	60/61	
Cranial CT	45.8% (65/142)	31.7% (19/60)	
MRI	88.0% (125/142)	93.3% (56/60)	
Cranial CT and MRI	33.8% (48/142)	25.0% (15/60)	
Both studies normal	95.8% (46/48)	93.3% (14/15)	
CT normal MRI not	2.1% (1/48)	6.7% (1/15)	
Thrombosis	0	7.1% (4/56)	

Abbreviations:
CSF = Cerebrospinal fluid pressure
CT = Computed tomography
IH = Intracranial hypertension
MRI = Magnetic resonance imaging
PCOS = Polycystic ovary syndrome
PIH = Primary intracranial hypertension
SIH = Secondary intracranial hypertension

* Some initial records did not include a CSF pressure measurement, but all individuals had a confirmed CSF pressure elevation on a subsequent study. Opening CSF pressure is expressed as cm H_2O. Data were not available for all subcategories.