ELSEVIER

Brain & Development 28 (2006) 190–195

BRAIN & DEVELOPMENT
Official Journal of the Japanese Society of Child Neurology

www.elsevier.com/locate/braindev

Original article

Pseudotumor cerebri as an important differential diagnosis of papilledema in children

Felix Distelmaier[a,*], Ulrike Sengler[b], Martina Messing-Juenger[c], Birgit Assmann[a], Ertan Mayatepek[a], Thorsten Rosenbaum[a]

[a]*Department of General Pediatrics, Heinrich-Heine-University Düsseldorf, Moorenstr. 5, D-40225 Düsseldorf, Germany*
[b]*Department of Ophthalmology, Heinrich-Heine-University Düsseldorf, Moorenstr. 5, D-40225 Düsseldorf, Germany*
[c]*Department of Neurosurgery, Heinrich-Heine-University Düsseldorf, Moorenstr. 5, D-40225 Düsseldorf, Germany*

Received 22 October 2004; received in revised form 19 April 2005; accepted 11 July 2005

Abstract

Introduction: Primary pseudotumor cerebri (PTC) in childhood is a rare but important differential diagnosis in children presenting with papilledema. It is defined as elevated cerebrospinal fluid (CSF) pressure of more than 20 cm H_2O, normal CSF composition, and exclusion of underlying structural or systemic causes. Visual loss is a serious complication, which requires careful monitoring and management. *Patients and methods*: We conducted a retrospective chart review of 12 patients with primary PTC. The mean age at presentation was $8^{2}/_{12}$ years, and there was a male-to-female ratio of 7:5. The aim of this study was to investigate the clinical features of primary PTC in children, and to highlight the different treatment options in normalizing intracranial pressure in these patients. *Results*: In the majority of cases, children presented with headache. Four patients had no obvious symptoms and papilledema was found on routine eye examination. Obesity was uncommon and there was no distinct sex predilection. Acetazolamide was our drug of choice for the initial treatment. Furosemide and prednisone were used as second-line agents. Treatment was gradually decreased after resolution of the papilledema with exception of the two youngest children, who remained symptomatic. One child underwent ventricular–peritoneal shunting. *Discussion*: The treatment goals of PTC are the relief of symptoms, and preservation of visual function. Acetazolamide is an effective first-line method of lowering raised intracranial pressure. In our study group especially the young children were difficult to treat. This might indicate an age-related difference in the etiology of PTC. When medical treatment remains ineffective and visual function deteriorates, surgical treatment should be considered.

Keywords: Pseudotumor cerebri; Papilledema; Childhood; Visual loss; Acetazolamide; Surgical treatment

1. Introduction

The differential diagnosis of papilledema in childhood includes a large spectrum of underlying diseases (intracranial mass lesions, hydrocephalus, cerebral venous thrombosis, etc.). Therefore, all children with papilledema warrant a systematic clinical approach and a detailed diagnostic evaluation. In the absence of obvious neuropathology, one important differential diagnosis is pseudotumor cerebri (PTC).

PTC is defined as elevated cerebrospinal fluid (CSF) pressure of more than 20 cm H_2O, normal CSF chemical and cellular analysis, normal or small ventricles and exclusion of underlying primary structural or systemic abnormalities. If no secondary causes are identified, the syndrome is termed primary PTC, or idiopathic intracranial hypertension (IIH).

The mechanism for the development of increased CSF pressure resulting in primary PTC is still not fully understood. There exist several theories explaining the underlying pathophysiology: elevated CSF pressure may arise from resistance to CSF outflow, decrease in CSF absorption, increased rate of CSF secretion, altered cerebral hemodynamics and increased brain capillary permeability [1–3].

* Corresponding author. Department of General Pediatrics, University Children's Hospital, Heinrich-Heine-University Düsseldorf, Moorenstr. 5, D-40225 Düsseldorf, Germany. Tel.: +49 211 811 7696; fax: +49 211 811 8757.

E-mail address: distelmaier@med.uni-duesseldorf.de (F. Distelmaier).

0387-7604/$ - see front matter © 2005 Elsevier B.V. All rights reserved.
doi:10.1016/j.braindev.2005.07.003

Hormonal influences on CSF pressure have been discussed on the basis of the distinct predilection for women in adult patients with primary PTC and the known association between obesity and the development of primary PTC. Many studies suggest that these theories of pathogenesis differ from those in prepubescent children with PTC [4–6].

Some conditions have been identified as causative agents of secondary PTC, including certain medications (e.g. vitamin A/D, several antibiotics, steroids, retinoic acid, lithium), endocrine abnormalities, autoimmune disorders, anemias, and cranial venous outflow abnormalities [7–11]. The role of associated diseases and medications seems to be stronger in children than in adults.

Chronic elevation of CSF pressure leads to impaired axoplasmic flow causing optic disc edema. Visual loss is a serious complication of PTC, which requires careful monitoring and management. Acetazolamide and furosemide are the first line medications for treatment of raised CSF pressure. When conventional medical therapy fails, surgical intervention is the only definitive treatment.

PTC in children may present with a different clinical picture compared to the typical syndrome of adulthood. Common clinical presentations include headache, neck pain, and vomiting. These symptoms are typically worse in the morning and improve during the day. Other clinical features are diplopia, tinnitus, transient visual obscuration, vertigo, and nystagmus. It is of great importance that an apparent lack of symptoms does not rule out chronic increased intracranial pressure, especially in young children.

The aim of this study was to investigate the clinical features of primary PTC in children, and to highlight the different treatment options in normalizing intracranial pressure in these patients.

2. Patients and methods

We conducted a retrospective chart review of children diagnosed with primary PTC over the past 3 years in the University Children's Hospital, Düsseldorf, Germany. The group of children identified consisted of 12 patients with a mean age at presentation of $8^{2}/_{12}$ years (range from $1^{6}/_{12}$ to $15^{9}/_{12}$ years) and a male-to-female ratio of 7:5 (see Table 1). All male patients were 11 years or younger, whereas three females were identified between the age of 12 and 15 years.

Initial evaluation consisted of clinical and neurological examination, as well as laboratory work-up. All patients underwent magnetic resonance imaging (MRI) of the head. If abnormalities in cerebral perfusion were suspected, magnetic resonance angiography (MRA) was performed. For the differentiation of papilledema from pseudopapilledema, fluorescein angiography was carried out in older children who were able to cooperate during this investigation (see Fig. 1). To obtain pressure measurements and a sample of the cerebrospinal fluid (CSF) for cellular, chemical, and microbiological examination, a lumbar puncture (LP) was performed. To exclude underlying causes of secondary PTC, extended laboratory work-up was done, including screening for anemia, chronic infection, endocrine abnormalities, and vitamin A and D levels.

Inclusion criteria for the diagnosis of PTC were signs and symptoms of increased intracranial pressure, a normal neurological examination apart from papilledema or a sixth nerve palsy, the absence of structural abnormalities

Table 1
Patient characteristics at initial presentation according to age and sex, clinical findings and treatment strategies

Patient/sex	Age at presentation (years)	Symptoms at presentation	Obesity at presentation (yes/no)	Ophthalmologic findings	CSF pressure at presentation (cm H_2O)	Treatment
1/M	$1^{8}/_{12}$	∅	No	Bilateral papilledema	28	VP-Shunt
2/M	$2^{6}/_{12}$	∅	No	Bilateral papilledema	30	Repeated LP
3/M	$3^{3}/_{12}$	∅	No	Bilateral papilledema	30	Acetazolamide
4/F	$5^{5}/_{12}$	Headache, visual obscuration	No	Bilateral papilledema	42	Acetazolamide
5/M	$6^{8}/_{12}$	Headache	No	Bilateral papilledema	26	Acetazolamide
6/M	$7^{2}/_{12}$	Headache, vomiting	No	Bilateral papilledema	43	Acetazolamide
7/F	$9^{7}/_{12}$	Headache	No	Bilateral papilledema	30	Acetazolamide
8/M	$10^{9}/_{12}$	∅	No	Bilateral papilledema	40	Acetazolamide
9/M	$10^{11}/_{12}$	Headache, visual obscuration	Yes	Bilateral papilledema	29	Acetazolamide
10/F	$11^{8}/_{12}$	Headache, vomiting	No	Bilateral papilledema	60	Acetazolamide
11/F	$13^{5}/_{12}$	Headache	Yes	Bilateral papilledema	26	Acetazolamide
12/F	$15^{9}/_{12}$	Headache, visual obscuration	Yes	Bilateral papilledema	37	Acetazolamide