Long-term follow-up of children with benign abducens nerve palsy

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Abstract

Purpose Benign abducens nerve palsy is rare in childhood. Diagnosis is made by exclusion, and the severe underlying pathologies have to be ruled out. The aim of our study was to present the largest single-center series of patients with the longest period of follow-up to confirm the benign nature of this entity.

Patients and methods We carried out a retrospective study of 12 consecutive children with benign abducens nerve palsy. All children underwent a careful orthoptic and ophthalmic examination during acute presentation and follow-up.

Results Painless palsies were associated with a preceding infection or immunization in five patients. The left eye was affected in nine children and no bilateral case was found. No sex differences were seen. Recovery was observed within 6 months in all cases, and ipsilateral recurrences occurred in three children. Three children required strabismus surgery. None of the patients developed long-term recurrences or neurological abnormalities during a mean follow-up of more than 9 years.

Conclusions Our data support earlier findings, such as painless and predominately left-sided occurrence, spontaneous recovery within 6 months, and ipsilateral recurrence. In contrast to much of the literature, we did not find a female preponderance. Exclusion of severe causes and close follow-up is mandatory for these patients. As none of the patients developed long-term recurrences or neurological sequelae, this entity can be regarded as a benign condition without malignant associations or complications. *Eye* (2010) 24, 74–78; doi:10.1038/eye.2009.22; published online 13 February 2009

Keywords: abducens nerve palsy; cranial nerve paresis; recurrent palsy; concomitant esotropia

Introduction

Extraocular muscle palsies can indicate the presence of a significant underlying pathology. They are even more alarming in childhood because of the missing vascular aetiology (diabetes and hypertension), which is the most prevalent cause in adult populations.^{1,2} The majority of acquired abducens nerve palsies in children are caused by intracranial tumours and trauma.^{3–5} The age- and sex-adjusted annual incidence of the third, fourth, and sixth nerve palsies combined in a paediatric population has been reported to be 7.6 per 100 000 population.⁶

Benign acquired isolated abducens nerve palsy is a rare presentation in children, and recurrences are even rarer. Many cases are idiopathic, but a distinct entity of benign abducens nerve palsies has been associated with viral infections or immunization.^{7–9} Other causes include migraine and neurovascular compression by aberrant vessels.⁵

The diagnosis is made by exclusion in a retrospective manner after an adequate period of close observation. Accordingly, the aim of our study was (1) to present clinical features in a larger case series; and (2) to extend the earlier-reported follow-up time for confirming the benign nature of this entity.

Materials and methods

A retrospective chart review of our institutional diagnostic database at the Department of Ophthalmology, University Hospital of Hamburg, Germany, was carried out for to identify all consecutive children with a history of abducens nerve palsy between January 1991 and July 2008. The original diagnoses had been made by ophthalmologists or neurologists; but in all patients, close follow-up examinations were carried out in the ophthalmology department.

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Inclusion criteria were benign abducens nerve palsy without any severe underlying pathology. Hence, traumatic, neoplastic, aneurysmal, and meningitic palsies were not considered. Congenital cases and Duane's retraction syndrome were also excluded. In all children, a careful orthoptic and ophthalmic examination including slit-lamp assessment and dilated indirect ophthalmoscopy during acute presentation and follow-up was carried out. In addition, all children underwent paediatric neurology assessment.

Patient demographics including age, gender, and length of follow-up were analyzed. The clinical charts of these patients regarding the circumstances leading to palsy were reviewed in detail, that is, infection signs (throat swabs were obtained, and blood was obtained for infective aetiology analysis in patients with suspected respiratory tract infections) and earlier immunizations were considered. Clinical characteristics obtained from medical records included ophthalmic findings, associations (neurologic findings and diagnostic imaging) and clinical course, as well as recovery periods and recurrences.

Data were collected and analyzed using the data analysis module from Microsoft Excel 7.0 (Redmond, WA, USA).

Results

The clinical data for each patient are summarized in Table 1. Over the 17-year period, 12 consecutive children (6 females, 6 males) with benign abducens nerve palsy were identified. The mean age at diagnosis was 15.3 months (range: 6–38 months). The follow-up time was between 28 and 210 months (mean: 111.7 months).

The left eye was affected in nine cases and no bilateral case was found. Neither parents nor their children reported severe pain associated with palsy. However, some discomfort was found in the children teething and/or undergoing infection. In 4 out of 12 children, palsies occurred after infections, whereas three children had a preceding respiratory infection (patients 3 and 6: throat infection, patient 5: throat and chest infection) and patient 2 had mild gastroenteritis. In patient 12, occurrence of the palsy followed immunization (pertussis, diphtheria, tetanus, poliomyelitis and infant Haemophilus type B vaccine). In addition, palsies were found in three teething children (patients 6, 10, and 11).

Imaging was carried out in nine cases. The computed tomography scans were normal in the first two children (patients 1 and 2). Cranial magnetic resonance tomography did not reveal any pathological findings in 7 of the remaining 10 patients. In three children, imaging was not carried out in agreement with paediatric neurologists. Furthermore, all ophthalmic examinations

were normal, that is, none of the children had papilloedema.

Recovery of palsies was observed within 6 months in all cases (range: 1.5–6 months). The mean-recovery time was 3.6 months. Ipsilateral recurrences were seen in only two patients (patients 1 and 8). However, parents reported a history of one similar episode in two cases (patients 7 and 8), which was confirmed by a consultant ophthalmologist for patient 7 on an outpatient basis. In all but one of our patients (patient 8), a complete recovery of the sixth nerve palsy was found. In patient 8, complete recovery occurred after each of the first two episodes. The third occurrence was followed by a mild left abduction deficit accompanied by a slightly incomitant esotropia (ET). Therefore, left medial rectus recession and lateral rectus tucking was carried out. As abduction-deficit and incomitant ET persisted, the patient underwent right medial rectus faden operation and left lateral rectus resection. The lateral incomitance was abolished successfully by surgery.

Two patients (patients 4 and 7) subsequently developed a concomitant ET. Eye muscle surgery was carried out, which led to microtropia in both cases. In patient 4, mild amblyopia developed despite occlusion therapy. However, none of the three patients who underwent surgery gained high-grade stereopsis (positive Titmus Fly Test in patient 8). In contrast, high-grade stereopsis was present in all other patients (positive Lang I Stereotest).

Apart from the noted recurrences, there were no other episodes of lateral rectus weakness or other neurological abnormalities identified in long-term follow-up.

Discussion

Patients with benign abducens nerve palsy have been found to share common features, namely, childhood occurrence, spontaneous recovery within 6 months in the majority of patients, ipsilateral recurrence, painless palsy, and female and left-sided preponderance.^{5,9} Our data support most of these findings, that is, spontaneous recovery occurred on an average within 3.6 months with no palsy lasting longer than 6 months. Recurrence was observed in only three patients (patient 8 with two recurrences). Palsies were painless and the left occurrence outnumbered right palsies by nine to three. However, no female preponderance was found, as the sex ratio was 1:1.

In three of the patients, an acquired ET developed during follow-up examinations. In one patient, this was due to an incomplete recovery of the abducens nerve palsy, whereas a concomitant ET occurred in two patients with complete recovery. After the angles of deviation were stabilized, surgery was carried out successfully in all of them leading to microtropia. However, none of the

Table 1 Clinical characteristics of patients with benign abducens nerve palsy

Case number/sex/ age on presentation (months)/Follow-up (months)	Ocular signs on presentation	Ophthalmic findings ^a	Associations/neurologic findings/ diagnostic imaging	Recovery	Clinical course, therapy	Stereopsis outcomes (seconds of arc)	Recurrence/ recovery (months)
1/M/38/210	Abnormal head posture, L: ET	L: 10° ET, abduction (−2), left face turn, VA: Bil: 10/10 (LH), Bil: normal anterior segment and fundus	None/normal/ CT: normal	Within 6 months	Complete recovery of abducens nerve palsy, 10 months later recurrence of the palsy (recovered completely)	550 (Lang I)	1/(3 months)
2/F/18/168	Past pointing, L: ET	L: 12° ET, abduction (−4), left face turn, VA: Bil: normal (PL), Bil: normal anterior segment and fundus	3-weeks history of a mild gastroenteritis/normal/ CT: normal	Within 6 weeks	Complete recovery of abducens nerve palsy	550 (Lang I)	None
3/M/12/152	Abnormal head posture, L: ET	L: 17° ET, abduction (−4), left face turn, VA: Bil: normal (PL), Bil: normal anterior segment and fundus	4-weeks history of a mild upper respiratory infection/normal/none	Within 2 months	Complete recovery of abducens nerve palsy	550 (Lang I)	None
4/F/6/135	L: ET	L: 30° ET, abduction (−4), VA: Bil: normal (PL), Bil: normal anterior segment and fundus, Bil: normal anterior segment and fundus	None/normal/ MRI: normal	Within 2 months	Complete recovery of abducens nerve palsy, but 2 months later development of concomitant left ET (45°), therefore, bilateral MR recession (5.5mm) and left LR tucking (7mm), post-operatively left ET (4°) and mild left amblyopia despite occlusion	No stereopsis	None
5/M/10/125	L: ET	L: 15° ET, abduction (−2), left face turn, VA: Bil: normal (PL), Bil: normal anterior segment and fundus	1-week history of an upper and lower respiratory infection/normal/ MRI: normal	Within 2 months	Complete recovery of abducens nerve palsy	550 (Lang I)	None
6/M/8/120	L: ET	L: 15° ET, abduction (−2), VA: Bil: normal (PL), Bil: normal anterior segment and fundus	4 weeks ago mild upper respiratory infection, teething/ normal/MRI: normal	Within 2 months	Complete recovery of abducens nerve palsy	550 (Lang I)	None
7/F/17/120	R: ET ^b	R: 20° ET, abduction (−2), VA: Bil: normal (PL), Bil: normal anterior segment and fundus	None/normal/ MRI: normal	Within 4 months	Complete recovery of abducens nerve palsy, but 3 months later development of concomitant right ET (20 - 25°), therefore, right MR recession (5mm) and LR tucking (6.5mm), postoperatively alternating ET (5°), no amblyopia	No stereopsis	None
8/F/7/115	L: ET ^c	L: 15°, abduction (−3), left face turn, VA: Bil: normal (PL), Bil: normal anterior segment and fundus	None/normal/ MRI: normal	Within 2 months	Complete recovery of abducens nerve palsy, 3 months later recurrence of the palsy, incomplete recovery with abduction (−1) and development of a slightly incomitant left ET (22°), therefore, left MR recession (5.5mm) and LR tucking (6.5mm), postoperatively left ET (10°), abduction (−1), 1 year later incomitant left ET (16°) with larger angle in left gaze, abduction (−1), therefore, right MR faden operation and left LR resection (4.5mm), postoperatively left ET (1°), no amblyopia	3000 (Titmus Fly)	1 (incomplete)
9/F/31/71	Abnormal head posture, L: ET	L: 7° ET, abduction (−1), left face turn, VA: Bil: normal (PL), Bil: normal anterior segment and fundus	None/normal/none	Within 4 months	Complete recovery of abducens nerve palsy	550 (Lang I)	None

Table 1 (Continued)

Case number/sex/ age on presentation (months)/Follow-up (months)	Ocular signs on presentation	Ophthalmic findings ^a	Associations/neurologic findings/ diagnostic imaging	Recovery	Clinical course, therapy	Stereopsis outcomes (seconds of arc)	Recurrence/ recovery (months)
10/M/10/65	L: ET	L: 10° ET, abduction (-2), VA: Bil: normal (PL), Bil: normal anterior segment and fundus	None/normal/ MRI: normal	Within 6 months	Complete recovery of abducens nerve palsy	550 (Lang I)	None
11/F/20/ 31	R: ET	R: 18° ET, abduction (-3), VA: Bil: normal (PL), Bil: normal anterior segment and fundus	Teething/normal/ MRI: Normal	Within 6 Months	Complete recovery of abducens nerve palsy	550 (Lang I)	None
12/M/6/28	R: ET	R: 12° ET, abduction (-3), right face turn, VA: Bil: Bil: normal (PL), Bil: normal anterior segment and fundus	5 days after vaccination/normal/ none	Within 6 months	Complete recovery of abducens nerve palsy	550 (Lang I)	None

M, male; L, left; ET, esotropia; VA, visual acuity; Bil, bilateral; LH, Lea-Symbols; CT, computed tomography; F, female; PL, preferential looking; MRI, magnetic resonance imaging; MR, medial rectus muscle; LR, lateral rectus muscle; R, right.

^aDeviation degrees (°) were measured using the prism cover test or using the Krimsky method. Motility impairment was divided into four grades (-1 to -4).¹⁰

^bParents reported a right abducens nerve palsy at the age of 12 months (confirmed by a consultant ophthalmologist), which spontaneously recovered within 4 months.

^cParents reported a left abducens nerve palsy at the age of 5 months, which spontaneously recovered within 6 weeks.

patients gained high-grade stereopsis, and in one case, mild amblyopia developed despite occlusion therapy. Possible evolution into a concomitant ET has earlier been reported.^{11,12} It has been noted that this development is clearly distinct from that seen in the sixth nerve palsy in adults.¹¹ Treatment guidelines include maintenance of occlusion therapy, as well as the need for prompt surgical intervention once the acquired strabismus is stabilized.¹¹

Aetiology of isolated acquired abducens nerve palsy in children includes serious causes, such as meningitis, Gradenigo's syndrome, posterior fossa tumour, trauma, hydrocephalus, and increased intracranial pressure.¹³ Benign abducens nerve palsy refers to cases without obvious pathology and those with less severe associations. These benign palsies may arise from viral aetiology (EBV, CMV, VZV), other infections (mycoplasma pneumoniae infection, Q fever, Lyme's disease) or follow immunizations.^{7-9,14-16} Therefore, palsies have been attributed to neurotropic effects of an infectious agent, as well as to parainfectious aetiology.¹³ Neurovascular compression by aberrant vessels and migraine have also been quoted as possible causes.⁵ We found infections preceding the palsies in four patients, and an association with immunization in 1 out of 12 patients. A coincidence with teething was observed in three cases.

To the best of our knowledge, this is the largest series of children with benign abducens palsy having the longest follow-up. None of the patients developed long-term recurrences or neurological abnormalities during a mean follow-up of more than 9 years. This point is worth observing, because the diagnosis of benign sixth nerve palsy is made by exclusion; and some underlying pathologies might only be diagnosed retrospectively.

In conclusion, we add more evidence that isolated abducens nerve palsy can be a benign condition. Our data support earlier findings, such as painless occurrence, spontaneous recovery within 6 months, ipsilateral recurrence, and left-sided preponderance. In contrast to much of the literature, we did not find a female preponderance, that is, the sex distribution was equal. Although the prognosis for benign isolated abducens nerve palsy is usually excellent, possible complications have to be considered. Management should include screening and treatment of amblyopia, as well as exclusion of a transition into concomitant non-paralytic esotropia. In cases of subsequent acquired strabismus, with a constant angle of deviation, strabismus surgery may be required.

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