Journal of Clinical Neuroscience 21 (2014) 735–740

Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

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

Clinical Study

Visual acuity and pattern of visual field loss at presentation in pituitary adenoma

Siddharth Ogra [a], Andrew D. Nichols [b,c], Stanley Stylli [b,c], Andrew H. Kaye [b,c], Peter J. Savino [d], Helen V. Danesh-Meyer [a,*]

[a] Department of Ophthalmology, Faculty of Medical & Health Sciences, The University of Auckland, Private Bag 92019, Auckland 1142, New Zealand
[b] Department of Neurosurgery, The Royal Melbourne Hospital, Parkville, VIC, Australia
[c] Department of Surgery, The University of Melbourne, The Royal Melbourne Hospital, Parkville, VIC, Australia
[d] Shiley Eye Centre, UCSD, La Jolla, CA, USA

ARTICLE INFO

Article history:
Received 9 January 2014
Accepted 26 January 2014

Keywords:
Chiasmal compression
Optic chiasm
Optic nerve
Pituitary adenoma
Pituitary tumour
Visual acuity
Visual field defect

ABSTRACT

Our purpose was to analyse the demographics, prevalence and pattern of visual field defects in patients with pituitary adenoma. We prospectively recruited 103 consecutive patients (206 eyes) presenting to a neurosurgical unit with pituitary adenoma. Ophthalmological examination and standard automated perimetry (Humphrey, 24-2 threshold) was performed. Severity of visual field defects was also assessed. The mean population age was 53.9 years (standard deviation = 15). Visual loss was the most common reason for presentation (39%) followed by endocrine abnormality (21%) and headache (15%). Patients with endocrine abnormality on presentation were 10.9 years younger than those presenting with visual loss ($p = 0.001$). Bitemporal defects were the most prevalent pattern (n = 22, 41%) followed by homonymous defects (n = 7, 13%). Of the patients with visual field loss, 33% had unilateral visual field defects. The mean visual acuity in those with bitemporal defects was 6/7.5 with half of these patients having 6/6 vision in both eyes. In conclusion, the majority of patients with pituitary adenoma have visual acuity better than 6/7.5 despite having visual field defects. While a bitemporal pattern of visual field loss is the most common, a significant proportion of patients had unilateral and altitudinal defects. Assessment of the visual field is essential to rule out chiasmal compression.

1. Introduction

The most common lesions that cause chiasmal compression are pituitary adenomas, accounting for approximately 10% of all intracranial neoplasms. Various patterns of visual field defects (VFD) have been described in patients with pituitary adenomas with the precise type of defect depending on the anatomy of the optic chiasm and its relation to the tumour. The typical VFD associated with pituitary tumours is bitemporal hemianopia, occurring when the body of the chiasm (which is comprised of the crossing nasal fibres of each optic nerve) is compressed by the enlarged gland. The defect may be complete, involving the whole hemi-field or partial, usually beginning superiorly and progressing inferiorly, depending on the degree of nerve compression. Anterior placed lesions can cause central scotomas and nerve fibre layer pattern VFD while posterior lesions may involve the optic tracts producing a homonymous hemianopia [1–7].

The purpose of this study was to analyse the severity and pattern of VFD in patients presenting to a neurosurgical unit with confirmed pituitary adenoma and to evaluate the association of visual acuity loss in different patterns of VFD.

2. Method

2.1. Subjects

Consecutive patients with pituitary tumours were identified and recruited from the Royal Melbourne Hospital Neurosurgical Unit clinic (Melbourne, Australia) over a 3 year period. The diagnosis of a pituitary tumor was confirmed by MRI and subsequently classified histologically following surgery. Patients with diabetes mellitus, glaucoma, intraocular pressure greater than 21 mmHg or other ocular disorders affecting the optic nerve or macula were excluded from the study.

Procedures adhered to the tenets of the Declaration of Helsinki, and the protocol was approved by the Melbourne Health Human Research and Ethics Committee. Informed consent was obtained

* Corresponding author. Tel.: +64 9923 6254.
E-mail address: h.daneshmeyer@auckland.ac.nz (H.V. Danesh-Meyer).

http://dx.doi.org/10.1016/j.jocn.2014.01.005
0967-5868/

from all patients. Patients underwent a full ophthalmic examination of both eyes, including visual acuity testing, slit-lamp biomicroscopy and automated perimetry.

2.2. Visual field testing

Static achromatic automated perimetry was performed with the Swedish Interactive Threshold Algorithm Standard 24-2 program of the Visual Field Analyzer (Humphrey Field Analyzer II; Carl Zeiss Meditec, Dublin, CA, USA) according to the manufacturer's recommendations, using a 4 mm^2 Goldmann size II stimulus (0.43°) on a 31.5 apostilb background. The differential light sensitivity threshold was determined at each test location. Patients whose visual field reliability indices fell outside these parameters were excluded: fixation losses >33%, false-positive responses >33%, and false-negative responses >33%. All visual fields were assessed by three clinicians (S.O., H.D.M., P.J.S.). Visual fields were classified both quantitatively and qualitatively. For the qualitative assessment, visual fields were classified based on the pattern of loss for each eye individually as well as bilaterally. Bilateral classification included bitemporal, homonymous, anterior junctional, generalised field depression, bilateral concentric, and unilateral. To classify as quadrantanopia, a minimum of three non-edge points had to be involved at the 1% level or lower on the pattern deviation plot. The defect also had to respect the vertical meridian. Defects extending past a single quadrant were classified as hemianopia. Superior and inferior field defects in a nerve fiber layer distribution were classified as altitudinal. Fields with defects involving all four paracentral points were classified as central scotoma.

The Hodapp-Parrish-Anderson (HPA) staging system was utilised to quantitatively grade the severity of each VFD independent of the pattern of visual loss. HPA categorises visual field loss into four distinct stages: 1 (minimal), 2 (early), 3 (moderate) and 4 (severe). Severity is determined by a combination of mean deviation (MD), points affected on the pattern deviation plot (stages 2–4) and proximity to fixation (stages 2–4). Pattern standard deviation (PSD), corrected PSD and the glaucoma hemifield test are additional factors used in classifying stage 1 visual field loss [8]. Advantages of this grading system include its widespread clinical use, structured classification utilising visual field parameters, and relative simplicity and suitability for retrospective review [9].

Statistical analysis was performed using the Statistical Package for the Social Sciences software version 20 (SPSS, Chicago, IL, USA). Significance level was set at $p < 0.05$. Descriptive statistics were used to summarise the data. Student's *t*-test was used to analyse continuous data. One way analysis of variance was used to analyse variance between groups while relationships between categorical values were assessed by chi-squared analysis. Correlation between variables was determined via the Spearman rank coefficient.

An inter-rater reliability analysis using the kappa statistic was performed to determine consistency among raters when grading the visual fields. A value of 0.2 or less represents poor agreement, 0.21–0.4 indicates fair agreement, 0.41–0.6 indicates moderate agreement, 0.61–0.8 indicates good agreement, and 0.81–1.0 signifies very good agreement [10]. Visual field graders demonstrated very good inter-rater reliability with kappa values above 0.875, $p \leqslant 0.001$. The mean kappa value between all raters was 0.913.

3. Results

3.1. Demographics

A total of 103 patients (206 eyes) were diagnosed with pituitary tumours over 3 years. Five patients had the diagnosis of Rathke's cleft cyst on histology, with the rest having confirmed adenoma.

Table 1
Demographics at presentation in patients with pituitary adenoma

	VFD (99 eyes) Mean (SD)	Normal (93 eyes) Mean (SD)	*p* value
Age, years	57.14 (14.2)	49.82 (14.2)	<0.001
BCVA, Snellen	6/7.5	6/6	<0.001
Severity, HPA	2.83 (1.02)	0.05 (.37)	<0.001
MD, dB	−8.01 (5.70)	−1.34 (1.77)	<0.001
PSD, dB	7.71 (3.99)	2.18 (1.45)	<0.001

BCVA = best corrected visual acuity, dB = decibels, HPA = Hodapp-Parrish-Anderson, MD = mean deviation, PSD = pattern standard deviation, VFD = visual field defects.

Fourteen eyes belonging to 12 patients did not meet visual field reliability criteria and were excluded from the unilateral analysis, leaving 192 visual fields from 91 patients. The 12 patients with at least one unreliable visual field were excluded from the bilateral visual field analysis but included in the analysis for each eye. Individual eyes meeting reliability criteria were included in the unilateral visual field and HPA severity analysis. A total of 99 eyes (52%) had VFD as measured by automated perimetry. Out of 91 patients with bilaterally reliable fields, 13 (14%) had unilateral defects.

Population age varied from 16–90 years old, with a mean age of 53.93 (standard deviation [SD] = 15.0 years). There were 53 men (52.5%) and 48 (47.5%) women. Mean best corrected visual acuity (BCVA) was 6/7.5 (Snellen equivalent). Of the entire cohort, 36 patients had BCVA of 6/6 or greater and 50 patients had acuity of 6/7.5 or greater in both eyes. Out of the individual eyes with VFD (n = 99), 40 (40%) had BCVA of 6/6 or better, and 55 (55%) had BCVA of 6/7.5 or better. Almost two thirds (66%) had visual acuity of 6/9 or better in the affected eye.

The MD varied significantly, ranging from 2.48 dB to −29.48 dB with a mean of −4.97 dB (SD = 5.80 dB). The mean PSD was 5.04 dB (SD = 4.11 dB, range 1.12–16.86 dB).

Patients with VFP (99 eyes) were compared to those with normal visual fields (93 eyes) (Table 1). Patients with VFD were significantly older (57.14 *versus* 49.82 years) and had significantly worse visual acuity. Those with VFD had a mean visual acuity of 6/7.5 (range count fingers to 6/4) and those with no defects 6/6 (range 6/24–6/4) although both groups had minimal visual acuity loss. There was no significant difference between right and left eyes, or male and female patients.

4. Patterns of bilateral visual loss

Of the 91 patients eligible for bilateral visual field analysis, 37 had bilaterally normal visual fields. The most common reason for presentation in these patients was endocrine abnormality (n = 14, 38%), followed by headache (n = 10, 27%). Four patients presented due to incidental findings on neuroimaging, and another four presented due to a recurrence in existing tumour growth. Three patients presented due to visual loss as their primary symptom, followed by two patients who presented for other reasons not previously described.

In patients with VFD (n = 54), bitemporal defects were present in 41% (n = 22) (Table 2). Patients with bitemporal VFD retained excellent visual acuity overall with a mean of 6/7.5. Upon closer analysis of those with bitemporal defects, 11 out of 22 patients (50%) had visual acuity of greater than or equal to 6/6 bilaterally. Six patients (27%) had visual acuity below 6/7.5 in both eyes with a mean visual acuity of 6/18 (range: 6/60–6/12). The remaining five patients (23%) showed unilateral reduction in visual acuity, with the better eye having a visual acuity of at least 6/7.5. The mean visual acuity of the affected eye was 6/15 (range 6/60–6/9).

Amongst those with bitemporal defects, seven patients had involvement of some part of the nasal field. Out of these seven