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Surgical intervention for binocular blindness in pituitary apoplexy

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ABSTRACT

Purpose: Bilateral blindness in patients with pituitary apoplexy is rare and infrequently studied. Visual outcomes after surgical decompression are unpredictable and predictors of favourable outcome not well defined. The purpose of this study was to determine whether vision can be salvaged in patients who present with bilateral blindness and what the time limit is before irreversible damage occurs.

Methods: We report a series of 5 patients who presented with bilateral blindness after pituitary apoplexy. Patients presented 1.5 to 15 days after losing complete vision. Four regained functional vision. All had endoscopic transsphenoidal decompression within 36 h of presentation. The 4 patients who had surgery within 7 days of ictus had recovery of functional vision. One patient presented late and was operated on day 15 post ictus, with no visual recovery. We review the literature regarding the incidence and outcome of bilateral blindness post-pituitary apoplexy and present the outcome of 52 patients from 1939 to 2011 who had surgical intervention.

Results: There was an 80% recovery rate in the current series vs 0% from the historical comparison ($p = 0.05$). Surgical approach in the historical comparison was significant ($p = 0.015$). Median age and median time delay from ictus to surgery were not significant.

Conclusions: Findings suggest that vision can be salvaged in patients who present with binocular blindness after pituitary apoplexy, especially if surgery is performed within the first 7 days of apoplexy. Even in delayed cases surgical decompression can be beneficial and should be performed to try and salvage functional vision.

1. Introduction

Pituitary apoplexy is defined as a haemorrhagic event or infarction within a pituitary tumour that causes sudden enlargement of the pituitary tumour with devastating and often life-threatening consequences. Pituitary apoplexy is a clinical diagnosis that can be confirmed by histopathological findings. The classic presentation is that of sudden decreased visual acuity that can be unilateral or bilateral, severe headaches with vomiting and ophthalmoplegia and sometimes, decreased level of consciousness. Bilateral blindness is rare and usually occurs secondary to compression of the optic chiasma.

The English literature describes patient outcomes with regards to decreased visual acuity or unilateral loss but there are no papers that specifically address the visual outcome after surgical decompression for bilateral blindness secondary to pituitary apoplexy. Agrawal [1] presents 6 cases of binocular blindness in his paper on the visual outcome of blind eyes. Few cases are described in the literature and by combining patients with bilateral blindness from different studies in the English literature, only 52 cases were found dating back to 1939 [2] [3]. We discuss our 5 patients with bilateral blindness and the fact that 4 out of the 5 patients had useful vision after surgery. The senior author (PS) published a series of six patients with bilateral blindness after pituitary apoplexy in 2005 [4]. In this series, none of the six patients had any functional vision following surgery. This second series of five patients shows an improvement in visual outcome to functional vision in four patients. We specifically look at the possible differences between these two studies, concentrating on the timing of surgery and the surgical approach.

Abbreviations: Visual acuity, VA; Endoscopic transsphenoidal surgery, ETSS; Magnetic resonance imaging, MRI

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Table 1
Pituitary apoplexy patients with binocular blindness from the literature.

Study	Surgical approach 1 = ETSS 2 = Before ETSS	Age	Sex	Time in days 1 = < 2 days 2 = 2–5 3 = 5.1–7 4 = 7.1–10 5 = > 10 days	Visual recovery 1 = Functional vision 2 = Blind
Lubbe, Semple	1	31	F	1	1
Lubbe, Semple	1	57	M	3	1
Lubbe, Semple	1	35	F	2	1
Lubbe, Semple	1	18	M	1	1
Lubbe, Semple	1	28	F	5	2
Semple, Web [4]	2	55	M	5	2
Semple, Web	2	72	M	2	2
Semple, Web	2	20	M	3	2
Semple, Web	2	53	M	2	2
Semple, Web	2	56	M	2	2
Semple, Web	2	38	F	1	2
Muthukumar [2]	2	42	F	3	1
Robinson [5]	2	58	F	2	1
Agrawal [1]	2	60	M	2	2
Agrawal	2	55	M	3	1
Agrawal	2	35	M	4	2
Agrawal	2	25	M	4	2
Agrawal	2	45	M	2	1
Agrawal	2	46	M	3	1
Henderson [6]	2				1
Henderson	2				1
Henderson	2				2
Henderson	2				2
Henderson	2				2
Henderson	2				2
Henderson	2				2
Laws[7]	2				2
Cohen[8]	2				2
Cohen	2				2
Cohen	2				2
Cohen	2				2
McLarty [9]	2			5	2
McLarty	2			5	2
McLarty	2			5	2
McLarty	2			5	2
McLarty	2			5	2
McLarty	2			5	1
Shenkin [10]	2			2	1
Parent [11]				1	1
Parent				1	1
Symon [12]	2				1
Symon	2				1
Onesti [13]				2	2
Onesti				2	2
Turgut [3]	2	30	M	3	2
Maccagnan [14]				2	2
Maccagnan				4	1
Chuang [15]	2	72	M	4	2
Chuang	2	78	F	3	1
Simon [16]					2
Takeda [17]	2	45	F	2	1
Gruber [18]					2

TS = Transsphenoidal; ETTS = Endoscopic Transsphenoidal Surgery; Blind = No light perception; Functional vision = able.

2. Patients and methods

This paper reports on a retrospective series of 5 patients who presented with bilateral blindness from pituitary apoplexy out of a series of 194 patients with pituitary tumours. The patients presented to the authors between January 2003 and 31 January 2016 at one academic institution, Groote Schuur Hospital, University of Cape Town, South Africa. Pituitary apoplexy was defined according to the classical clinical pathognomonic features, MRI findings and histological confirmation. Bilateral blindness was defined as the absence of light perception in both eyes. Functional vision was defined as the ability to conduct activities of daily living independently.

A review was done regarding all documented cases of binocular blindness following pituitary apoplexy reported in the English literature that we were able to source. A PubMed search was performed using the medical subject heading (MeSH) keywords: blindness and pituitary apoplexy. All articles dating back to 1939 were reviewed and patients with bilateral blindness as defined by no light perception in both eyes were included in the review (Table 1). Only patients who underwent surgery were included and patients treated conservatively or expectantly were excluded. Eighteen articles were included in this systematic review [1–18]. One paper was excluded due to inadequate information supplied by the authors regarding the nature of the suprasellar tumours causing the blindness [19]. This paper had been previously included in a review paper on pituitary apoplexy where the authors did an overview of 186 cases of monocular and binocular blindness post pituitary apoplexy [3]. In this study the authors include a series of 18 patients with binocular blindness but in actual fact the study quoted never specified the nature of the suprasellar tumours [19]. Included in this series of 18 patients were patients who were diagnosed with meningiomas and craniopharyngiomas.

Data collected from the 18 papers were analysed and all patients with bilateral blindness were included, looking specifically at the duration of blindness before surgical decompression, the age and sex of the patient, the surgical approach and visual outcome after surgery. The visual outcome after surgery and the time to surgery was compared between the 2 series by the same author and between our series and the 47 other cases of binocular blindness found in the literature. Comparisons of proportions were made using Fisher's exact test, and medians were compared using the Wilcoxon rank-sum (Mann-Whitney) test using Stata version 12.1 (StataCorp LP, 4905 Lakeway Drive, College Station, TX 77845, USA).

3. Results

We report a series of 5 patients who presented with binocular blindness secondary to pituitary apoplexy during a 13-year period (2003–2016). The median age was 31 years (range 18–57 years). Forty percent of these patients were male. All patients presented with binocular blindness (no light perception), fixed dilated pupils and optic atrophy. All underwent endoscopic transsphenoidal surgery to decompress the optic chiasma. The median time delay between ictus and surgery was 3.5 days (range 1.5–15 days). Three patients underwent surgery within 3.5 days, 1 within 7 days and 1 within 15 days of the ictus. All regained functional vision from total blindness except for the patient who had surgery at 15 days. This series contrasts with the previous study reported by Semple et al. where 6 out of 62 pituitary apoplexy patients presented with blindness and none regained functional vision after surgery [4]. The median age in this series was 54 years (range 20–72 years) and the sex ratio was skewed toward a larger male proportion 83.33%. Comparison of the median ages and the proportion male in the two series did not show statistically significant differences ($p = 0.2$ and $p = 0.2$ respectively). The median time delay between ictus and surgery was 4.0 days (range 1–60 days) with 1 patient operated on within 24 h, 4 within 4 days, and one patient after 60 days. Although the median time difference, 3.5 versus 4.0 days, is interesting it was not found to be statistically significant (Table 2). Tumour size comparisons could not be made due to absence of radiological data in the older series. In the current series however, none of the tumours were giant. The largest tumour measured 39.7 × 31 × 22 mm in the sagittal, coronal and axial planes respectively. The only marked difference in the management of these patients was the surgical approach. In the first series by Semple et al., 3 patients had a craniotomy and 3 had transsphenoidal surgery using the operating microscope and not the four-handed endoscopic approach that was used in the second series of 5 patients. In all the endoscopically resected tumours, the extent of resection was subtotal, where the goals

Table 2
Comparison of the two South African series.

Variable	Visual recovery N = 4	No visual recovery N = 7	*p*-Value
Time delay in days (median[b])	2.5 (1.5–7)	4 (1–60)	0.2
Age in years (median[b])	53	33	0.4
Surgical approach (proportion[a] ETSS)	0%	100%	0.002

[a] Proportions were compared using Fisher's exact test.
[b] Medians were compared using the Wilcoxon rank-sum (Mann-Whitney) test.

Table 3
Comparison of the prognostic factors for visual recovery in two series.

Variable	Visual recovery N = 4	No visual recovery N = 7	*p*-Value
Time delay in days (median[b])	2.5 (1.5–7)	4 (1–60)	0.2
Age in years (median[b])	53	33	0.4
Surgical approach (proportion[a] ETSS)	100%	14%	0.015

[a] Proportions were compared using Fisher's exact test.
[b] Medians were compared using the Wilcoxon rank-sum (Mann-Whitney) test.

of surgery were to achieve adequate decompression and capsular descent without a pursuit of gross total resection. All patients in both studies received high-dose corticosteroid replacement therapy. When comparing the visual outcome in the 2 series we found that there was a statistical significance ($p = 0.015$) despite the small numbers in both studies. In the first series by Semple et al., 0 out of 6 (0%) patients regained vision in contrast with 4 out of 5 (80%) in the second series where endoscopic transsphenoidal surgery was performed in all patients (Table 3). Although not the primary objective, the long term oncological outcome of the series is summarised in (Table 4).

A review of the literature returned 18 papers regarding pituitary apoplexy and included 52 patients with binocular blindness who all had surgery with 20 out of 52 regaining useful vision, including the 4 patients in our series. Out of the 20 that regained functional vision, 4 patients had surgery within 48 h after ictus, 5 between 2 and 5 days, 5 between 5.1 and 7 days, 1 patient between 7.1 and 10 days and only 1 patient regained vision after surgery was delayed by more than 10 days. In 4 cases the time delay was unknown.

The surgical approach in many cases was not specified and no comparison can therefore be made between the different approaches except in the two series from Cape Town. Many of the studies however pre-date endoscopic surgery and one must assume that studies prior to the 1990s describe either decompression using a craniotomy or transsphenoidal surgery utilising the operating microscope [4,5,12].

4. Discussion

Pituitary apoplexy is a rare entity with only a small percentage of patients with pituitary adenomas presenting with the classic pathognomonic features. Mohr and Hardy documented only 4 (0.6%) out of 664 pituitary adenoma patients to have clinical features consistent with pituitary apoplexy [20]. At surgery, however, 64 (9.6%) had features of necrosis or haemorrhage consistent with an apoplectic event. In a large series of 2021 patients with pituitary adenoma from China, 4.8% had pituitary apoplexy with 5 out of 97 presenting with blindness. This series however, did not specify whether blindness was bilateral or unilateral [23]. The incidence of binocular blindness secondary to apoplexy is unknown and we could only find 52 cases where surgery was performed described in the literature using a PubMed search.

Binocular blindness after pituitary apoplexy is a devastating event and physicians and surgeons often believe that complete blindness is irreversible and that patients should be treated conservatively [18]. Gruber et al. [18] suggest in their retrospective review of 30 patients with pituitary apoplexy that conservative management is indicated in patients who present with binocular blindness. Four out of 30 patients had binocular blindness, only one had surgery and the other 3 were treated conservatively. One of the 3 conservatively managed patients regained useful vision. No useful conclusion can however be made on reviewing one patient who had decompressive surgery for binocular blindness. The time interval between apoplexy and surgery was also not indicated in this review. Woo et al. reported on 12 patients with apoplexy from a series of 359 over a 13 year period. Two had unilateral blindness and both experienced functional recovery after decompressive surgery. In this retrospective study however, none of the patients had binocular blindness and the authors did not specify the transsphenoidal route used for decompression [24].

Other studies reviewing the visual outcome of patients with binocular blindness from pituitary apoplexy have included patients with other suprasellar tumours in their reviews [3,19]. The inclusion of meningiomas and craniopharyngiomas could have potentially skewed the visual outcomes with the risk of readers taking a more conservative approach to patients presenting with binocular blindness. Studies quoting the success rate of conservative management when compared to surgical management were uncontrolled and retrospective with the degree of visual loss not always comparable between the two groups [18,21,22].

Our small series of 5 patients demonstrate that useable vision is achievable, especially if performed early. The collation of all reported cases supports our findings and suggests that surgery is beneficial, especially if performed within 7 days. Looking at the collative data, the 20 patients who regained vision did so if decompressive surgery was performed within 7 days, except for 2 patients who recovered useful vision, one between 7 and 10 days and one after 10 days. Comparing the 2 series by Semple and Lubbe, we see that the first series where no patients regained useful vision, the median age was higher at 54 years versus 31 years in the group where 4 out of 5 patients recovered vision. Although interesting, this was not statistically significant.

No real explanation can be given for the contrasting visual outcomes between the two series conducted by the same author. The outcome was

Table 4
Summary table of latest series regarding follow up treatment and oncological response after apoplexy. FEBRT- fractionated external beam radiotherapy.

Cases	Tumour outcome	Repeat surgery	Radiotherapy	Duration of follow up	Vision outcome
Patient 1	Empty sella	No	No	3 yrs	Improved
Patient 2	Stable residual	No	Yes- FEBRT 50.4 Gy (1 yr)[a]	2 yrs	Improved
Patient 3	Empty sella	No	No	12 yrs	Improved
Patient 4	Empty sella	No	No	8 yrs	Improved
Patient 5	Progressive-declined further treatment	Yes × 2 (3 yrs/6 yrs)[a]	Yes- FEBRT 50.4 Gy (6 yrs)[a]	7 yrs	Unchanged

[a] Data in brackets represent number of years from initial presentation.

statistically significant (p-value 0.015). It could well be mere coincidence but the fact that the surgical technique was the only identifiable differentiating factor might be of significance ($p = 0.002$). The difference in the median time frame between apoplexy and surgery also differed in the 2 studies by the same author (3.5 versus 4.0 days) and although likely to be important in the management of patients, it was not found to be statistically significant due to the small sample size.

The four-handed endoscopic transsphenoidal approach allows for better visualisation and manoeuvring of instruments in the pituitary fossa. Angled endoscopes allow lateral and superior visualisation that is not achievable using the operating microscope. This then might allow better decompression of the optic chiasma. The surgical approach in the series comparison was statistically significant. The importance of prospective data capturing and collaboration between pituitary surgeons to collect data is highlighted so that useful conclusions can be drawn.

The main limitation of this study is its retrospective nature, particularly the comparison with an even older cohort. This has resulted in a failure to adequately compare tumour volume between the two groups due to incomplete data, a factor that could influence the degree of chiasmatic compression and subsequent visual recovery. Also, not all patients received early post-operative imaging to document the extent of tumour resection. None of these patients had preictal visual testing, so the extent to which any visual recovery approximated visual acuity prior to apoplexy is unknown.

5. Conclusion

Functional vision is achievable in patients who present with binocular blindness after pituitary apoplexy. The best visual outcome will be obtained if surgical decompression is performed within 5 days of the apoplectic event, and no later than 7 days. Functional vision has been obtained in one patient after 10 days. Prospective data is needed to evaluate whether the endoscopic transsphenoidal approach might have better success rates with regards to visual outcome.

Declaration of Competing Interest

The authors declare no conflict of interest, neither financial or personal in the preparation of this manuscript. No funding was received in support of this research.

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