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Outcome indicators for vitrectomy in Terson syndrome

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ABSTRACT.

Purpose: **There is no general agreement on the best indication and timing of vitrectomy in patients suffering from Terson syndrome. Therefore, we reviewed our cases in order to assess factors interfering with the functional outcome and complication rates after vitrectomy.**

Methods: **In this retrospective consecutive case series, the records from all patients undergoing vitrectomy for Terson syndrome between 1975 and 2005 were evaluated.**

Results: **Thirty-seven patients (45 eyes) were identified, 36 of whom (44 corresponding eyes) were eligible. The best-corrected visual acuity (BCVA) at first and last presentation was 0.07 ± 0.12 and 0.72 ± 0.31, respectively. Thirty-five eyes (79.5%) achieved a postoperative BCVA of ≥ 0.5; 26 (59.1%) eyes achieved a postoperative BCVA of ≥ 0.8. Patients operated on within 90 days of vitreous haemorrhage achieved a better final BCVA than those with a longer latency (BCVA of 0.87 ± 0.27 compared to 0.66 ± 0.31; $P = 0.03$). Patients younger than 45 years of age achieved a better final BCVA than older patients (0.85 ± 0.24 compared to 0.60 ± 0.33; $P = 0.006$). Retinal detachment developed in four patients between 6 and 27 months after surgery. Seven patients (16%) required epiretinal membrane peeling and seven cataract surgery.**

Conclusion: **Ninety-eight per cent of our patients experienced a rapid and persisting visual recovery after removal of a vitreous haemorrhage caused by Terson syndrome. A shorter time between occurrence of vitreous haemorrhage and surgery as well as a younger patient age are predictive of a better outcome. Generally, the surgical risk is low, but complications (namely retinal detachment) may occur late after surgery.**

Key words: case series – epiretinal membrane – non-traumatic vitreous haemorrhage – outcome – pars-plana vitrectomy – subarachnoid haemorrhage – Terson syndrome

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Introduction

Intraocular bleeding in the context of acute subarachnoidal haemorrhage (SAH) is deemed a rare event, but the number of unrecognized cases may well be underestimated because of the severity of the underlying systemic condition (Nowosielska & Czarnecki 2003; Nowosielska et al. 2003). Reported incidences range between 10.5% and 37.5% (Roux et al. 1991; Kuhn et al. 1998; Nowosielska & Czarnecki 2003). If neurosurgical centres do not perform an ophthalmological examination routinely, only a minority of patients are diagnosed at the time of SAH; every seventh patient referred for post-acute phase rehabilitation may suffer from visual handicap (Wietholter et al. 1998). The majority of intraocular haemorrhages extend intra- or subretinally, without breakthrough into the vitreous cavity (Meier & Wiedemann 1996; Nowosielska et al. 2003). Bleeding into the vitreous cavity caused by SAH is referred to as Terson syndrome (in honour of the French ophthalmologist Albrecht Terson, who described this association more than 100 years ago; Terson 1900). Terson syndrome may be observed in 8–14.5% of SAH instances (Kuhn et al. 1998; Wietholter et al. 1998; Nowosielska & Czarnecki 2003), representing 5.5% of all non-diabetic and non-traumatic vitreous haemorrhages (VHs) (Verbraeken & Van Egmond 1999).

Intraocular haemorrhage seems to be associated with more severe subarachnoidal haemorrhage: 89% of patients with intraocular haemorrhage had a history of coma, compared to 46% of those without intraocular haemorrhage (Roux et al. 1991; Kuhn et al. 1998). The presence of intraocular haemorrhage is linked to a higher morbidity, whereas it is no longer associated with an increased mortality rate (Gutierrez Diaz et al. 1979; Roux et al. 1991). The precise pathophysiological mechanism of disease has not been agreed on fully (Castren 1963; Meier & Wiedemann 1996; Ogawa et al. 2001). Many eyes may regain a satisfying visual acuity after spontaneous resorption of VH during the following months or up to 1 year later (Khan & Frenkel 1975; Schultz et al. 1991; Meier & Wiedemann 1996; Nacef et al. 2004). There is a chance for spontaneous resorption (Schultz et al. 1991), a significant risk of complications (Körner & Meier-Gibbons 1992; Yokoi et al. 1997; Augsten et al. 2000; Gnanaraj et al. 2000; Ritland et al. 2002), namely in younger individuals including the development of amblyopia (Kuhn et al. 1998; Capone 2003) and an occasionally observed poor outcome, despite successful surgery, caused by optic atrophy (Wietholter et al. 1998; Ogawa et al. 2001). Some may argue against an early intervention in individual patients (Daus et al. 1992; Wietholter et al. 1998). On the other hand, a good to excellent outcome of vitrectomy with a low surgical risk and a fast and profound functional recovery has been reported during recent years and may allow an early social rehabilitation of patients (Roux et al. 1991; Körner & Meier-Gibbons 1992; Wietholter et al. 1998; Augsten et al. 2000; Gnanaraj et al. 2000; Sharma et al. 2002).

Because most published case series are rather small, we wished to revise a larger series of our own consecutive cases in order to assess factors interfering with the functional outcome and complication rates after vitrectomy for Terson syndrome.

Table 1. Functional recovery after vitrectomy for Terson syndrome ($n = 44$).

	Mean	SD	Minimum	Maximum
Age (years)	45.5	11.8	26.6	70.0
Follow-up (months)	23.2	26.5	0.3	124.3
BCVA at first presentation	0.07	0.12	0.01	0.5
Last BCVA	0.72	0.31	0.05	1.2
Best BCVA	0.79	0.28	0.16	1.2
Latency (days)	146	119	21	669

BCVA, best-corrected decimal visual acuity; SD, standard deviation.

Table 2. Descriptive data from patients not meeting the criteria for vitrectomy in Terson syndrome ($n = 11$).

	Mean	SD	Minimum	Maximum
Age (years)	59.2	12.3	35.5	80.9
Follow-up (months)	25.8	60.3	0 ($n = 2$)	214.6
BCVA at first presentation	0.28	0.33	0.01	1.25
Last BCVA	0.51	0.40	0.01	1.25
Best BCVA	0.53	0.42	0.01	1.25
Latency (days)	216	409	0 ($n = 2$)	1082

BCVA, best-corrected decimal visual acuity; SD, standard deviation.

Materials and Methods

In this retrospective interventional case series, we identified all patients who had been referred to our vitreoretinal clinic and who had been treated by vitrectomy for VH arising in the context of acute SAH during a 25-year period from 1979 to 2004 ($n = 37$, 45 eyes). Part of this case series has been published previously, and we wished to add longer follow-up times (Körner & Meier-Gibbons 1992). One patient had to be excluded because his mental state did not allow us to assess his visual acuity. Therefore, 36 patients and 44 eyes were eligible for this study (Table 1). We also identified a series of patients not meeting the criteria for vitrectomy presenting at our outpatient ambulance during the past 10 years; these patients did not have sufficiently long and close follow-up, therefore they were not included ($n = 11$; Table 2). Of the patients not undergoing surgery, nine were female; mean age was 59.2 ± 12.3 (35.5–80.9) years; best-corrected decimal visual acuity (BCVA) at first presentation was 0.28 ± 0.33 (0.01–1.25). In this group, the general state of health, the progress of neurorehabilitation, the wishes of the patients and their relatives and the visual expectations resulting from less strong residual vitreal opacifications, optic atrophy and pre-existing macular pathology argued against surgery.

Patient demographics

The age and gender of each patient, as well as information about preoperative findings including visual acuity and ultrasonographically assessed state of the retina prior to surgery, and the time lapse between subarachnoidal haemorrhage and vitrectomy, were recorded together with the postoperative function and anatomical findings.

Timing of surgery and intraoperative data relating to surgery

Until 1992, we observed eyes with vitreal haemorrhage for at least 3 months before offering vitrectomy in order to optimize the risk–benefit ratio if the partner eye allowed spatial orientation. More recently, we offered the option of vitrectomy according to the patient's wishes and the impact of vision on the rehabilitation process if medical aspects did not indicate otherwise. Moreover, the neurologically reported state of general and neurological recovery was registered and patients operated after a satisfactory stabilization of their general condition had been achieved. Thirty-six of the 44 eyes were operated on with a two-port vitrectomy and indirect ophthalmoscopy (FK). The remaining eight eyes received a standard three-port vitrectomy. Additionally required surgical procedures – such as placement of an encircling band, cryotherapy, air or gas tamponade and endolaser – were recorded, together with the duration of surgery and the type of anaesthesia.

Perioperative data

On admission, all eyes had been subjected to a thorough ophthalmological examination. All patients undergoing vitrectomy were scheduled for postoperative visits on day 1, after 1–2 weeks, after 1 and 6 months and regularly thereafter based on the postoperative clinical course. On each occasion, information respecting the following parameters was recorded: BCVA, intraocular pressure (IOP) and anterior and posterior segment morphology. This included the assessment of the optic nerve head, the macula and the peripheral retina, as well as any optically relevant irregularities and disturbances. Surgical success was defined as a stable increase of visual acuity of at least two lines after last surgery in case of revisions.

Statistics

Statistical analysis was performed using Statistica for Windows, KERNEL version 5.5 (StatSoft Inc, Hamburg, Germany). Quantitative data were expressed as means (± standard deviation) and minimal as well as maximal values (range). Qualitative data were displayed in absolute numbers and percentages. For statistical purposes, hand motion and counting fingers at a distance of 60 cm corresponded approximately to visual acuities of 0.001 and 0.01, respectively. Data recorded prior to vitrectomy and at the last examination were compared statistically. The data were confirmed to be normally distributed, using Shapiro–Wilk statistics. Quantitative data were compared using Student's *t*-test. Qualitative data were compared using Pearson's Chi-squared test. Differences between sets of data were considered to be significant if *P*-values were < 0.05 (on the basis of two-tailed tests).

Results

Of the 36 patients who underwent vitrectomy, 23 were female (64%; $P = 0.02$). The mean age was 45.5 ± 11.8 (26.6–70.0) years; the time delay between intracranial bleeding and vitrectomy was 146 ± 119 (21–669) days. Postoperatively, patients were followed up for 23.2 ± 26.5 (0.3–124.6) months (Table 1).

BCVAs at presentation and at last presentation were 0.07 ± 0.12 and 0.72 ± 0.31, respectively. In all but one instances (97.8%), last BCVA was better than that at presentation ($P < 0.01$). Thirty-five eyes (79.5%) then achieved a BCVA of at least 0.5; beyond these, 26 (63.9%) achieved a BCVA of 0.8 or better (Fig. 1).

The comparison of BCVA according to the delay between haemorrhage and vitrectomy showed that patients who were operated on within 90 days of haemorrhage achieved better final visual acuities than their counterparts with delayed vitrectomy: BCVAs were 0.87 ± 0.27 and 0.66 ± 0.31, respectively (*t*-test for paired samples: $P = 0.03$). Finally, a differentiation of visual acuities according to age showed a BCVA for patients up to 45 years of age of 0.85 ± 0.24 compared to 0.60 ± 0.33 for patients above 45 years of age (Student's *t*-test for unpaired samples: $P = 0.006$). This is not explained fully on the basis of postoperative cataract formation (Table 3). One patient was pseudophakic at the time of vitrectomy; seven patients received an intraocular lens (IOL) during the postoperative follow-up, six of whom belonged to the group of older patients.

Surgery for vitrectomy took 44 ± 23 (15–120) min. Because of the intraoperative detection of retinal lesions, an encircling band had to be placed in five instances (11%); a local sponge buckle was placed in one patient. Cryotherapy was performed in 16 instances (35%), endolaser coagulation in four (9%), a peeling of epiretinal membranes in seven (15%) and an air tamponade in 12 (26%). Optic atrophy was found in one patient during surgery, and one patient suffered from pre-existing esotropia and amblyopia. One patient presented with tractional retinal detachment (RD) at the time of vitreous surgery; this was treated successfully. Four patients (9%) had to undergo a total of seven re-operations because of proliferative viteoretinopathy (PVR)-associated RD, with postoperative intervals of 6, 7, 12 and 27 months after vitrectomy, respectively. The delay between VH and vitrectomy was 45, 138, 193 and 211 days, respectively.

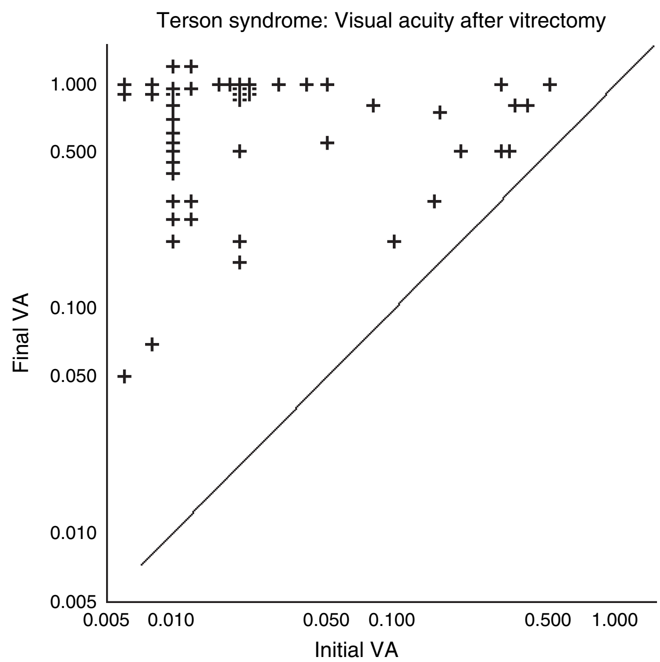

Fig. 1. Development of best-corrected decimal visual acuity ($n = 44$).

Discussion

Ninety-eight percent of our patients experienced a rapid and persisting visual recovery after removal of the VH caused by Terson syndrome; 91% achieved this with a single vitreoreti-

Table 3. The impact of age on best-corrected visual acuity at last examination ($n = 44$).

	All	< 45 years ($n = 23$)	≥ 45 years ($n = 21$)	*P*-value*
Posterior cataract	10 (22.7%)	3 (13%)	7 (33.3%)	0.15
Nuclear cataract	13 (29.5%)	0	13 (61.9%)	< 0.0001
Posterior and/or nuclear cataract	16 (36.4%)	3 (13%)	13 (61.0%)	< 0.001

* Fisher exact test (two-sided).

nal intervention. Patients with a delay between haemorrhage and vitrectomy of less than 3 months and patients younger than 45 years of age experienced a better functional recovery than did older individuals and those with surgery postponed for more than 3 months. Neither of these findings has been demonstrated before. Moreover, we found that RD may occur over 6 months after vitrectomy. This is perhaps related more to a secondary shrinking of the vitreous base or a delay in surgery (as in three out of four of our own patients) than to surgical trauma.

Clearly, our analysis suffers the disadvantages of a retrospective case series. Nevertheless, the follow-up for the majority of patients is rather long. Our results may also explain controversial observations from the literature by confirming that a delay of vitreoretinal surgery appears to be associated with an increased risk of complications (Roux et al. 1991; Velikay et al. 1994; Meier & Wiedemann 1996; Yokoi et al. 1997; Ritland et al. 2002; Nacef et al. 2004). Moreover, we add further evidence that early vitrectomy in general may be favoured; therefore, it is a simple low-risk procedure to allow fast recovery from visual handicap in Terson patients in the absence of obvious disadvantages (Schultz et al. 1991; Daus et al. 1992; Körner & Meier-Gibbons 1992; Kuhn et al. 1998; Augsten et al. 2000; Gnanaraj et al. 2000; Sharma et al. 2002), although we are aware that this clinical impression is as yet not supported by prospectively collected evidence.

Consistent with published evidence, we detected a perimacular ring intraoperatively in several of our own patients (Keithahn et al. 1993; Srinivasan & Kyle 2006). This has been reported to develop as a consequence of a preretinal or retrohyaloideal haemorrhage (Friedman & Margo 1997; Kuhn et al. 1998). Surprisingly, this was not associated with epiretinal membranes, which were present in 15% of our patients; epiretinal membranes have been described in 16% (Gnanaraj et al. 2000), 32% (Ritland et al. 2002) and up to 59% (Yokoi et al. 1997) of patients in other studies. A pre-existing optic atrophy was present in one patient in our series; this seems to be a less frequent finding (Ritland et al. 2002). It may have developed as a consequence of the subarachnoidal haemorrhage or because of damage to the peripapillary tissue, as has been shown by fluorescein angiography (Ogawa et al. 2001). The functional potential might be quantified preoperatively by the use of visually evoked potential (VEP) (Wietholter et al. 1998). However, we would favour an immediate vitrectomy without routinely applying preoperative electrophysiological testing in a questionable case in order to improve the remaining binocular and visual field function.

Early recognition of Terson bleeding may be helpful in planning rehabilitative measures. This can be achieved in two thirds of instances at the time of SAH from the first computed tomography (CT) scans (Swallow et al. 1998). There is though no general agreement on the best time for vitrectomy. Arguments for early vitrectomy may be to hasten visual recovery and to reduce the risk of complications of VH (i.e. PVR and ghost cell glaucoma) (Körner & Meier-Gibbons 1992; Augsten et al. 2000; Gnanaraj et al. 2000; Ritland et al. 2002; Sharma et al. 2002) and an overall low rate of surgical complications (Kuhn et al. 1998; Wietholter et al. 1998; Augsten et al. 2000; Gnanaraj et al. 2000; Sharma et al. 2002). Therefore, the time course and completeness of spontaneous resorption of the VH have, as yet, not been described well; it may take several years to do so (Khan & Frenkel 1975; Shaw & Landers 1975; Schultz et al. 1991; Nacef et al. 2004). Also, a complication rate that has not been established definitively to be low (Yokoi et al. 1997; Kuhn et al. 1998; Gnanaraj et al. 2000; Ritland et al. 2002) argues for a delay of vitrectomy; some authors even suggest performing vitrectomy only after the failure of spontaneous resorption of intraocular haemorrhage (Ritland et al. 2002; Nacef et al. 2004). Our experience and that of many other vitreoretinal surgeons clearly indicates a different attitude. On the other hand, one observational study indicates that VH does not resorb within 19 months in nearly half of patients (Shaw & Landers 1975).

In summary, our results add to published knowledge that a shorter time between VH and surgery, as well as a younger patient age, are predictive of a better outcome. Generally, the surgical risk is low. In rare instances, complications (namely retinal detachment) may occur late after surgery, necessitating information for the patients and long-term ophthalmological follow-up.

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