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Visual Outcomes after Vitrectomy for Terson Syndrome Secondary to Traumatic Brain Injury

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Purpose: To evaluate visual outcomes after vitrectomy for intraocular hemorrhages secondary to traumatic brain injury.

Design: Retrospective, observational case series.

Participants: A total of 28 eyes in 20 patients undergoing vitrectomy for Terson syndrome secondary to traumatic brain injury between 1997 and 2015.

Methods: We reviewed the records of patients undergoing a standard 20-gauge or 23-gauge pars plana vitrectomy for intraocular hemorrhages secondary to traumatic brain injury, and the timing of vitrectomy in relation to the inciting intracranial event was recorded.

Main Outcome Measures: The primary outcome measure was the change in the preoperative visual acuity score at postoperative month 1 and at the last noted clinic appointment.

Results: A total of 28 eyes in 20 patients (all male) underwent pars plana vitrectomy for intraocular hemorrhages secondary to traumatic brain injury. The mean preoperative baseline logarithm of the minimum angle of resolution (logMAR) (Snellen) best-corrected visual acuity (BCVA) was 1.81±0.56 (20/1290). At 1-month postoperative follow-up, the mean BCVA was 0.30±0.33 (20/40). At the date of the last follow-up, the mean BCVA was 0.15±0.24 (20/30) and the median BCVA was 0.00 (20/20). Although the difference between preoperative and postoperative BVCA was significantly different at 1 month and the final postoperative clinic visits ($P < 0.001$), there was not a correlation between preoperative visual acuity as a predictor of final postoperative visual acuity outcome ($r = -0.32$; $P = 0.09$; 95% confidence interval [CI] $-0.62 - 0.06$). At the date of the last follow-up, the differences in visual outcomes between the individuals undergoing vitrectomy within 3 months of the inciting event, 0.08±0.15 (20/25), were not significantly different than those undergoing surgical intervention after 3 months, 0.18±0.27 (20/30) ($P = 0.28$). Three cases among those undergoing vitrectomy after 3 months were complicated by retinal detachment, none of which resulted in a BCVA worse than when the patient originally presented preoperatively.

Conclusions: In this retrospective series of patients without other ocular pathology, surgical intervention effectively provided rapid visual recovery in the majority of individuals with intraocular hemorrhages secondary to traumatic brain injury, irrespective of the timing of vitrectomy or of preoperative visual acuity. *Ophthalmology 2016;■:1–5 © 2016 by the American Academy of Ophthalmology*

Supplementary video is available online at www.aaojournal.org.

Terson syndrome is a relatively rare entity originally described as vitreous hemorrhages that occur in conjunction with an acute subarachnoid hemorrhage.[1–3] Over time, the term has been applied more broadly and now is often used to characterize intraocular hemorrhages that occur in combination with any type of acute intracranial hemorrhage.[4–7] Transient hemorrhage-induced spikes in intracranial pressure are believed to be an underlying factor in the etiopathogenesis of Terson syndrome, and the increased pressure is transmitted along the optic nerve, resulting in disruption of retinal vessels from venous hypertension.[8] Vitreous and retinal hemorrhage ensues. Partly because of the increased morbidity and mortality associated with its presence,[5,7,9–11] intracranial hemorrhage–induced ocular bleeding is frequently missed clinically, but surveillance studies suggest that some form of intraocular hemorrhage occurs in 8% to 29% of all acute subarachnoid hemorrhages.[7,10–16] When the underlying intracranial pathology is secondary to traumatic brain injury, intraocular hemorrhages are thought to occur less frequently than with other causes of Terson syndrome, such as ruptured intracranial aneurysm.[5]

A majority of patients with vitreous hemorrhages from Terson syndrome have favorable visual acuity outcomes without surgical intervention, with more than 80% of individuals in 1 cohort achieving a final best-corrected visual acuity (BCVA) of 20/50 or better.[17] When more rapid visual

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rehabilitation is desired, in patients in whom the vitreous hemorrhage is dense, or when the hemorrhage fails to resolve after a period of observation, surgical vitrectomy is often pursued. Prior reports indicate vitrectomy for vitreous hemorrhage in Terson syndrome results in rapid and meaningful visual recovery in most patients.[12,17–19] However, little is known about how the timing of vitrectomy using a modern technique in Terson syndrome affects postoperative visual outcome, particularly when the mechanism of intracranial pathology is traumatically induced.[19] We report the visual acuity results of a multicenter review of individuals undergoing early versus delayed vitrectomy for Terson syndrome associated with traumatic brain injury.

Methods

Approval for the study was first obtained from the institutional review board of all 3 participating centers (L.V. Prasad Eye Institute, Hyderabad, India; Kresge Eye Institute, Wayne State University, Detroit, MI; Washington University Eye Center, St. Louis, MO). A retrospective comparative study was then performed of patients who underwent vitreoretinal surgery by the 8 operating physicians between December 1997 and July 2015 for intraocular hemorrhages secondary to traumatic brain injury. All research adheres to the tenets of the Declaration of Helsinki, and the work is Health Insurance Portability and Accountability Act compliant.

Once patients were identified, all documentation was reviewed and baseline patient characteristics were obtained, including age at diagnosis, gender, diagnostic procedures, cause and duration of intracranial hemorrhage, and history of ophthalmic surgery. Each patient underwent an eye examination before surgery, their BCVA was recorded where possible, and B-scan ultrasonography was performed in eyes in which the degree of vitreous hemorrhage precluded adequate visualization of the posterior pole by indirect ophthalmoscopy. To eliminate causes of vision loss not mediated by Terson syndrome in this operative outcomes analysis, all eyes with rhegmatogenous or tractional retinal detachments diagnosed before surgery, direct penetrating or blunt ocular trauma, orbital fractures, or grades 3 to 5 relative afferent pupillary defects[20] were excluded.

After preoperative written informed consent, all patients underwent a standard 20-gauge or 23-gauge pars plana vitrectomy. Additional surgical procedures, such as endolaser, membrane peel, or silicone oil or gas tamponade, were performed as indicated for intraoperative retinal tears, retinal detachment, or treatment of an epiretinal membrane. The BCVA at 1 day and 1 month, and a final BCVA, were recorded. Count finger vision and hand motion vision at 2 feet were extrapolated to logarithm of the minimum angle of resolution (logMAR) 2.0 and 3.0, respectively.[21]

The cohort was divided into 2 groups by the timing of vitrectomy in relation to the date of initial injury. Those who underwent vitrectomy less than 3 months after the onset of the intracranial event were classified as early vitrectomy, and individuals whose vitrectomy occurred more than 3 months after the initial diagnosis were classified as delayed vitrectomy. The primary outcome was the change in BCVA score from baseline to the final visit. Descriptive statistics, *t* test, Fisher exact test, and Pearson correlation coefficient were used for comparison ($P < 0.05$ denoted significance).

Results

A total of 28 eyes in 20 patients (all male) with a mean age of 36.57±11.57 years (range, 18–61 years) underwent pars plana vitrectomy for intraocular hemorrhage associated with Terson syndrome (Videos 1 and 2, available at aaojournal.org) between December 1997 and July 2015 (Table 1). All patients sustained a traumatic brain injury from motor vehicle accidents, resulting in intracranial hemorrhage–induced intraocular bleeding. The most common presenting symptom was sudden onset of painless vision loss, and the median duration of symptoms before surgical intervention was 115.50±139.58 days. Apart from vitreous hemorrhage, 3 eyes had subhyaloid hemorrhages and 1 eye had a subinternal limiting membrane hemorrhage. One eye was pseudophakic at baseline.

The mean preoperative baseline visual acuity was 1.81±0.56 logMAR (20/1290 calculated Snellen). The median follow-up duration after surgery was 8.7 months. On the first postoperative day, the mean visual acuity was 1.26±1.01 (20/360). At the 1-month postoperative follow-up, the mean BCVA was 0.30±0.33 (20/40), with a mean improvement of 1.51 logMAR units from baseline ($P < 0.001$). At the final follow-up visit, the mean BCVA was 0.15±0.24 (20/30) and the median BCVA was 0.00 (20/20). This also was significantly different from the preoperative visual acuity ($P < 0.001$). The only eye without visual acuity improvement had a retinal detachment first noted at the time of vitrectomy, which ultimately required a second operation and resulted in a final BCVA equivalent to the visual acuity when the patient first presented with vitreous hemorrhage (1.00 logMAR units). Although the difference between preoperative and postoperative BVCA was different at 1 month and the final clinic visit, of significant interest was the finding that there was not a linear relationship between preoperative and final postoperative visual acuity outcomes ($r=-0.32$; $P = 0.09$, 95% confidence interval [CI] −0.62 − 0.06) (Fig 1).

Eight eyes underwent vitrectomy less than 3 months after developing vitreous hemorrhage. The median time before vitrectomy in this group was 40 days, and the range was from 21 to 79 days. Twenty eyes underwent surgery more than 3 months after the inciting traumatic event, and the median time before vitrectomy in this group was 133 days, with a range from 93 to 770 days. The mean preoperative BCVA was 1.93±0.15 (20/1700) in the early vitrectomy group and 1.77±0.65 (20/1200) in the late vitrectomy group, and the difference in the baseline vision between the 2 groups was not significant ($P = 0.31$). At 1 month after vitrectomy, the early vitrectomy group had a mean BCVA of 0.16±0.17 (20/30), the late vitrectomy group had a mean BCVA of 0.36±0.37 (20/50), and the difference remained nonsignificant ($P = 0.09$). At the date of the last follow-up, the differences in visual outcomes between the 2 groups were not significant: 0.08±0.15 (20/25) for early vitrectomy, 0.18±0.27 (20/30) for late vitrectomy ($P = 0.28$).

In the delayed vitrectomy group, 1 eye developed an epiretinal membrane (3.6% of the entire cohort) and 3 eyes developed a retinal detachment at the time of or after the initial vitrectomy (10.7% of the entire cohort). The eyes with retinal detachments were managed with endolaser retinopexy and silicone oil tamponade, and 2 eyes required an additional operation. No eyes in the early vitrectomy group developed retinal detachments or were noted to develop a significant epiretinal membrane. The difference in the rate of postoperative complications between the early and late vitrectomy groups was not significant ($P = 0.29$).

Discussion

Castren[22] first recommended vitrectomy for Terson syndrome in 1963. Since then, many reports have been published focusing on surgical outcomes for predominately aneurysmal causes of Terson syndrome.[6,12,18,19,23] Although these reports have been generally applied to all