The Effect of Early Bilateral Sequential Phacovitrectomy for Terson's Syndrome on Neurorehabilitation

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Abstract

The benefits of phacovitrectomy in patients with Terson's syndrome are well-known; however, it is less commonly performed as an immediate bilateral sequential surgery. The effects of phacovitrectomy on neurorehabilitation have also not previously been described.

A patient with subarachnoid haemorrhage developed Terson's syndrome and underwent a bilateral sequential phacovitrectomy. Following surgery, there was a significant improvement in cognitive ability due to visual improvement. This case demonstrates that early ophthalmology assessment and intervention may be beneficial in patients with Terson's syndrome undergoing neurorehabilitation.

Case presentation

A male patient in his 50s presented with acute right-sided leg weakness and confusion. His past medical history included a transient ischaemic attack, for which he took dual antiplatelets, and hypertension. On examination, the right pupil was fixed and dilated, and the Glasgow Coma Scale (GCS) was 11 ($E_4V_2M_5$). A CT head scan confirmed a Fisher Grade IV

subarachnoid haemorrhage (SAH), secondary to a ruptured anterior communicating artery aneurysm with associated hydrocephalus. The Hess and Hunt grading of the patient's clinical condition was 3 out of 5. The patient underwent external ventricular drain (EVD) insertion, coil embolization, a change of EVD, lumbar drain, and finally, insertion of a right parieto-occipital ventriculoperitoneal shunt two months later.

The patient's visual issue became apparent six weeks after the initial presentation when the intensive care unit staff noticed he was unable to see his meals. An ophthalmic assessment was then carried out, revealing vision to be hand movements bilaterally, with poor red reflex and no fundal view due to vitreous haemorrhage in both eyes. There was no relative afferent pupillary defect, and intraocular pressure was normal. B-scan ultrasonography confirmed a flat retina in both eyes. The patient was diagnosed with Terson's syndrome (TS), and the initial plan was for observation. However, upon moving to his local hospital, subsequent visual acuity was perception of light bilaterally, prompting the need for urgent surgery.

Immediate bilateral sequential 23-gauge transconjunctival pars plana vitrectomy was performed after phacoemulsification with intraocular lens implantation under general anaesthesia, nine weeks after the diagnosis of TS (15 weeks after his initial presentation with SAH).

Ten days postoperatively, the patient's visual acuity had improved from light perception to 6/9 uncorrected binocular vision. The patient was more alert and oriented to person but not time or place. A post-operative neuropsychiatry assessment reported that the patient continued to display signs of cognitive and memory impairment, poor orientation, and lack of insight, but was now able to follow two-part verbal instructions and complete executive tests that demonstrate some level of working memory. This assessment suggested that he was potentially responsive to rehabilitation interventions and may benefit from a rehabilitation-enriched environment to improve physical function, to support ongoing management and onward discharge options. The patient's spouse noticed a significant improvement and was thrilled that the patient could engage more fully post-vitrectomy.

Discussion

Terson's syndrome was first described by French Ophthalmologist Albrecht Terson in 1900 and refers to any unilateral or bilateral intraocular haemorrhage, including vitreous, sub-hyaloid, intra-retinal, or sub-retinal bleeding that is caused by intracranial haemorrhage or traumatic brain injury. [1] While 79% of TS is due to subarachnoid haemorrhage (SAH),[2] TS has an incidence of 14-29% in patients with a subarachnoid haemorrhage. [3]

Possible mechanisms for the pathophysiology of TS include a direct extension of blood from the subarachnoid space into the orbit via the optic nerve sheath. [4] An alternative theory proposes that dilation of the retrobulbar optic nerve compresses the central retinal vein and obstructs venous outflow, thereby rupturing smaller retinal venules. [5] Most bleeds are thought to manifest within the first hour of intracranial haemorrhage, while other cases can be delayed by days or weeks after the initial bleed. [6] In SAH-related TS, common factors include aneurysmal rupture of the anterior circulation, unconsciousness, raised intracranial pressure (ICP), lower GCS, and a higher Hess and Hunt grade or Fisher

grade IV on initial CT. [4][7]

Diagnosis of TS is primarily through fundal examination, and B-Scan ultrasonography in cases where the fundus cannot be visualised. Early recognition of TS is useful; however, diagnosis may be delayed due to limited communication from the patient. Visual impairment, particularly in bilateral cases, is associated with poorer neuro-physical rehabilitation outcomes and prognosis. [1] In those with TS and SAH compared to SAH alone, there is a 14-fold increase in mortality and a poorer neurological outcome. [8][9]

Although some patients with TS display spontaneous regression of intraocular haemorrhage, the condition may require surgical intervention with pars plana vitrectomy (PPV), particularly in cases of bilateral vitreous haemorrhage. Multiple studies have shown the beneficial effects and low complication rates of PPV on the final visual acuity of TS patients with non-clearing vitreous haemorrhages. A review of 124 case reports found that all 157 eyes had improved visual acuities post vitrectomy. [9] This review also showed that complication rates for vitrectomy in TS are low, but included retinal detachment, tears, macular hole, and one endophthalmitis. [9]

One small study of patients with bilateral TS concluded that PPV should be carried out in at least one eye no later than four to eight weeks after the acute injury, as eyes that underwent PPV six months after the initial injury displayed severe complications such as ring-shaped proliferations, tractional retinal detachments, and haemorrhagic macular cysts. [2] Moreover, untreated or un-resolving TS can lead to significant and irreversible ocular damage such as proliferative vitreo-retinopathy, cataracts, retinal breaks, retinal detachment, raised intraocular pressure, and macular hole. [5] The most ideal candidates for early vitrectomy are visually immature infants and adults with bilateral vitreous haemorrhages that are unlikely to resolve in a reasonable period of time. [10] Others that can be considered include those with poorer final predicted visual acuities; for example, patients with TS caused by hypertension-induced intracranial haemorrhage have poorer final visual acuities than those with ruptured intracranial aneurysm. [11]

Bilateral immediate sequential PPV is rarely performed. A case series of 14 patients who had bilateral immediate sequential vitreoretinal surgery found no adverse outcomes and suggested that immediate sequential surgery is more suitable for patients that are unable to tolerate the procedure under local anaesthesia. [12] We would suggest that in patients with bilateral TS where the optimum window of opportunity for vitrectomy is narrow and the risks of general anaesthesia are high, immediate sequential surgery is preferable to minimise delayed treatment to the second eye as well as reducing the systemic risks associated with a second general anaesthesia if the procedures were to be carried out separately.

PPV may or may not be combined with phacoemulsification to either treat concurrent cataracts or avoid the need for cataract surgery in the near future. It has been reported that 80% of PPV patients develop lens opacification during the first 2 years after surgery. [13] Furthermore, consideration should be given to the challenges of performing phacoemulsification after PPV as victrectomised eyes can present with capsular damage and zonular weakness, a harder nucleus and instability of the anterior chamber, rendering the intervention more difficult than routine cases. A retrospective study of 87 patients found that combining PPV with phacoemulsification is safe and allows for quicker rehabilitation and

final functional outcomes that are comparable to groups undergoing the procedures separately. [14]

Patients with TS often require extensive neurorehabilitation for neurological deficits that occur as a result of their primary brain haemorrhage. As well as being essential for engagement with the environment and mobility, vision is beneficial for reading, language processing, and subsequently as an input for memory. [15] It is well known that impairments in visual capacities lead to deficits in cognition and motor control and that both early and late interventions in improving visual acuity support cognitive recovery. [16] Improvements in visual acuity enable the patient to access and engage with efforts of neurorehabilitation and can lead to reduced length of hospital stay, increased cognition, bladder and bowel control, psychosocial scores, self-care, and mobility. [17]

To the best of our knowledge, there are no other reported cases that portray the direct benefits of early vitrectomy on neurorehabilitation. It is also an example of bilateral immediate sequential phacovitrectomy, which is less frequently performed than surgery performed in each eye at different times. In our case, bilateral phacovitrectomy improved the visual acuity, which in turn improved rehabilitation potential and working memory. The temptation for these patients is to allow some degree of stabilisation prior to vitrectomy; however, we would suggest that the earliest, safest, and practicable opportunity allows for the greatest outcome from a visual and rehabilitation perspective. The complication rate for phacovitrectomy is low, and when compared to the potential ocular complications that may develop following long periods of conservative management, the significant benefits that can be reaped following surgery make the case for early vitrectomy.

It is perhaps not surprising that better visual acuity improves neurorehabilitation as it allows better awareness and understanding of the surrounding environment and recognition of loved ones; however, the documentation of this in patients with TS has not previously been published. Allowing the additional sense of sight to be perceived could increase understanding of other tactile, auditory, and vestibular senses in these patients, and improved sight and particularly depth perception can improve patients' confidence and ability with grasping and locomotion. All of this can greatly assist patients in their neurorehabilitation journey.

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