Transient bilateral post-operative visual loss in spinal surgery

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Abstract

Background Post-operative visual loss (POVL) following spinal surgery is a rare but devastating complication. Although a number of intra-operative and post-operative factors have been implicated, the exact etiology may still remain unclear.

Purpose To report a unique case of transient bilateral POVL in a patient who had undergone lumbar surgery in the prone position.

Study design/setting This patient was followed up prospectively for 1 year.

Methods Prospective follow-up of a single patient following spinal surgery, who developed transient bilateral POVL.

Results This patient's visual loss improved within 48 h.

Conclusion This is the only documented case of POVL to have resolved completely within 48 h.

Keywords Post-operative · Visual loss · Spinal surgery

Introduction

Of the many different complications resulting from spinal surgery, post-operative visual loss (POVL) is uncommon, but with devastating morbidity and dire consequences for

the affected individual. It is estimated that 1 case per 100 spine surgeons annually will have a significant vision complication after surgery [1], and recent studies have shown that spinal surgery is now the leading cause of POVL, replacing cardiac surgery [2–4]. The three recognized causes of POVL are ischemic optic neuropathy (ION), central retinal artery thrombosis and cortical blindness [5].

Ischemic optic neuropathy is the most frequently cited cause of POVL following general anesthesia [1]. This has been reported following spinal surgery in the prone position, although the exact etiology perhaps still remains largely unclear [6, 7]. Pre-operative risk factors include hypertension, diabetes, polycythemia, smoking, renal failure, narrow angle glaucoma, morbid obesity, atherosclerotic vascular disease and collagen vascular disorders [8]. Intra-operative risk factors for developing ION include estimated blood loss greater than 1 l, operating time greater than 6 h, prone position, hypotension and anemia [9, 10]. We report a unique case of a patient who developed 'transient' bilateral POVL after lumbar surgery in the prone position, which resolved completely within 48 h.

Case report

A 44-year-old gentleman (height 168 cm, weight 105 kg, hemoglobin (Hb) 13.5 g/dl, PCV 41.5%), who was otherwise well with no other significant co-morbidities, was initially diagnosed with a myxopapillary ependymoma of the sacrum 3 years previously at which time he underwent L5/S1 laminectomy and a palliative resection of tumor at another institution. He then presented to our office with worsening lower back pain and some loss of control with bowel and bladder function. MRI of his lumbosacral and pelvic regions demonstrated a large sacral mass extending

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rostrally to the L5 level and involving the entire sacrum. After various treatment options were discussed, a combined decision was made with the patient, to proceed with sacrectomy and lumbo-pelvic reconstruction with instrumentation.

He was brought to the operating room and initially positioned supine. Under general anesthesia, an endotracheal tube was inserted and Mayfield pins positioned into the sides of his skull. The patient was then taken from the supine position and placed prone on an Andrews frame. Areas of pressure were carefully padded and his head was placed in the Mayfield head frame, which suspended his face avoiding any pressure. Care was taken to make sure that the eyes had no pressure points.

Laminectomies were performed at L4 and L5 exposing a normal thecal sac in this region. At the L5 level, significant scar tissue was encountered and an incidental durotomy sustained. The tumor had spread intrathecally quite substantially and it was then decided that resection of this tumor given the adhesions of the dura to the tumor as well as to the surrounding previously operated on tissue would place him at significant risk for bilateral L5 and S1 nerve root dysfunction, making him unable to walk post-operatively. Therefore, only a lumbo-pelvic instrumentation and arthrodesis (with transpedicular (L3–L5) and iliac wing screws connected with rods) was performed. The durotomy was closed using a running 5-0 Prolene suture and then reinforced with DuraGen and Tisseel fibrin glue. Prior to closure of the lumbosacral fascia, two subfascial drains were placed and carried out through separate stab incisions. The wound was closed in layers and the patient was taken from the prone position and placed supine. The Mayfield pins/head frame was removed without complications.

The systolic blood pressure had been maintained between 100 and 120 throughout the operation. The estimated blood loss was 1,500 cc, intra-operative Hb 9.8 (PCV 28.7%), post-operative Hb 12.4 g/dl (PCV 36.5%) and the patient had received only one unit of packed red blood cells intra-operatively. In addition, he was administered 5,700 ml of replacement fluid (including 1,500 ml of 3% normal saline). The operating time was less than 8 h, but the patient had been prone in total for 10 h. He was extubated and transferred to the neurosurgery ICU post-operatively. All his vital signs were stable and he was not noted to have any significant facial swelling.

Upon waking, he complained of bilateral visual loss. He was subsequently seen by ophthalmology who noted that he had decreased light perception and limited papillary responses bilaterally without any disc edema. They diagnosed a bilateral ‘posterior ischemic optic neuropathy (PION),’ which was managed by maximizing the hemoglobin, hematocrit and systolic blood pressure to assure perfusion. High dose steroids are not indicated in PION and

were not given. In addition, he had bilateral VI nerve palsy, likely due to CSF leak and contusion to the nerve sustained intra-operatively. Neuroimaging did not reveal any evidence of embolic phenomenon. His vital signs remained stable. Within 24 h, his vision was improving and he was able to read large print. At the 48-h stage, his vision, including the abducens palsy, had fully recovered and Hb was 9.7 (PCV 29.5%). His hospitalization was additionally complicated by a CSF leak which was treated by lying the patient flat and careful monitoring. When the wound had healed and it was assured that there was no leakage, the patient was deemed safe to be discharged home. His vision remains perfect at the 1-year follow-up and his condition remains stable with regard to the sacral tumor.

Discussion

This is a unique case, in that most other reports on POVL show patients who do not improve after suffering this devastating complication [1, 4, 11–13]. Our patient had transient POVL, which resolved completely within 48 h. ION occurs after an ischemic insult to the optic nerve and can be divided into anterior ischemic optic neuropathy (AION) and PION depending on the location of the lesion [14]. An edematous disc with or without peripapillary flame-shaped hemorrhage on early fundoscopic examination and a relative afferent pupillary defect or reduced pupillary light reflex are diagnostic of AION [14]. A normal early fundoscopic examination with a relative afferent pupillary defect or absent light reflex is the criterion consistent with PION and eventually optic nerve pallor is seen both in AION and PION [14]. Lack of any fundoscopic findings before the appearance of isolated optic nerve pallor has been categorized as non-specific ION [14, 15]. In a recent report, Lee et al. [10] found that there were no intra-operative factors directly under the control of the anesthesiologist. A diagnosis of ION following anesthesia does not necessarily suggest that there was intra-operative extrinsic pressure on the eye, as POVL secondary to intra-operative extrinsic pressure on the eye usually has a different ophthalmological examination finding [16]. In reported cases, the diagnosis is commonly retinal artery thrombosis, with the fundoscopic appearance of retinal pallor with a characteristic ‘cherry red spot’ [1].

The American Society of Anesthesiologists closed claims database reported that 81% of POVL was diagnosed as ION and the remainder as retinal artery thrombosis; 67% of all the reported cases of POVL occurred after spinal surgery in the prone position [13]. Another risk factor is intra-operative hypotension and anemia. In our case, blood pressure was tightly controlled and maintained between 100 and 120 mmHg throughout the operation. Our patient

lost 1,500 cc of blood and required only one unit of transfusion with packed red cells. Throughout the operation, there was no evidence of reduced end-organ perfusion, as manifested by metabolic acidosis, decreased urine output or ECG changes. This suggests that a moderate degree of blood loss does not per se fully explain PION. However, the POVL Registry data by Lee et al. [10] suggested that even a blood loss of over 1,000 cc was a significant contributor to ION.

Increased intraocular pressure is also a recognized risk factor for POVL. This can be attributed to a number of factors including direct pressure on the globe and increased central venous pressure (CVP). This is increased by reduced venous return in the head-down position and obstruction to venous outflow if the head is turned to one side [13]. CVP is also increased if there is direct pressure on the abdomen due to malpositioning on an operating table, compressing the abdomen and obstructing venous return to the heart [13]. Our patient's head was secured after induction of anesthesia with Mayfield pins without any pressure on the globe and was positioned correctly on an Andrews frame in a neutral position. We were especially careful to pad all pressure areas and there were no signs of ecchymosis on our patient's face or body. The CVP was maintained throughout (between 4 and 10 mmHg). The POVL Registry data has shed light on the importance of the duration of surgery (94% cases took 6 h or longer) as significant factors associated with POVL [10]. The operating time in our patient was 8 h and he had been prone for a total of 10 h and this may have an important role in his POVL.

Fluid overload has also been mentioned as possibly playing a role in POVL [16]. In the review by Baig et al., an average of 9,700 cc of crystalloids were infused in cases of ION, compared with 4,600 cc in others, whereas the hematocrit value comparison was not statistically significant [14]. Previously, these two factors had been discussed in the literature with an overemphasis on post-operative anemia and with perhaps only infrequent mention of the importance of over-hydration. Both of these factors may be interrelated and their significance is difficult to discern [13]. Our patient was given a total of 5,700 cc replacement fluid (including 1,500 cc of 3% normal saline), which may be an additional risk factor. However, the CVP was tightly maintained (between 4 and 10 mmHg) and the PCV did fall slightly (pre: 41.5%, intra-operative 28.7%, post-operative 36.5%, day 2 post-operative 29.5%).

Our patient was scheduled for major surgery, but ended up having lesser surgery due to the extent of scarring encountered and the extent of tumor. It is likely that a combination of modest increments in length of surgery in the prone position (8 h), blood loss (1,500 cc) and fluid overload (5,700 cc) may have all contributed to a reduction in perfusion pressure (the difference between mean arterial

pressure and intraocular pressure) to the optic nerve intra-operatively and resulted in the POV [12]. However, the CSF leak during the incidental durotomy should have had a 'protective' effect on this—it has been suggested that intracranial pressure is decreased in patients with ocular hypotension and vice versa [17]. The resolving nature of our patient's POVL is only the third case reported [4, 18] and the only documented case to resolve completely within 48 h.

Spine surgeons must especially be aware of the factors which when combined can increase the risk of POVL. With prolonged procedures, substantial blood loss or both are anticipated, and patients should be informed of the small but very significant nature of this complication. High-risk patients should be positioned so that the head is level with or higher than the heart and maintained in a neutral forward position (10° reverse Trendelenberg position) [19], with careful maintenance of vital observations intra-operatively and avoiding fluid overload. Staging of spinal procedures that are anticipated to be lengthy and with substantial blood loss may also be considered and the use of a Mayfield pins/head frame may help to reduce the pressure on the eyes. Our case highlights that even when some of these parameters are met, this devastating complication can still occur. Fortunately, as in our case, it was quick to resolve.

Conflict of interest None of the authors has any potential conflict of interest.

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