

PERIOPERATIVE OCULAR INJURY

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Overview

- General incidence
- Corneal abrasions
- Visual loss – incidence
- Types of visual loss
- Risk factors
- Strategies for prevention
- ASA recommendations

Eye Injury Associated with Anesthesia

Moos DD, Lind DM. Journal of Perianesthesia Nursing 2006; 21(5): 332-341
Gild WM, Posner KL, et al. Anesthesiology 1992; 76:204-8

- Eye injury accounts for 3-8% of anesthesia-related malpractice claims
- General anesthesia 83%
- Monitored anesthesia care 11%
- Conduction blockade 7%
- Incidence of corneal abrasion:
 - Roth 1996 – 0.034% (non-ophthalmic surgery)
 - Cucchiara 1988 – 0.17% (neurosurgical, mostly prone)

Eye Injury Associated with Anesthesia

Gild WM, Posner KL, et al. Anesthesiology 1992; 76:204-8
Lee LA, Posner KL, et al. Reg Anesth Pain Med 2008; 33:416-422

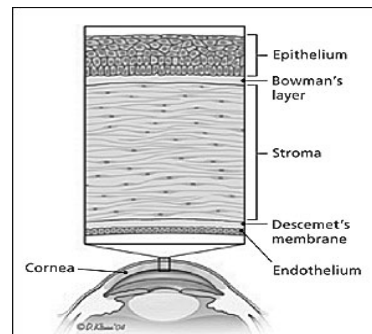
- 30% of claims were for eye injury associated with movement during eye surgery
 - Blindness was outcome in all cases
 - Median payment high (\$90,000)
- If you do eye blocks:
 - You will have a significantly altered risk profile related to permanent eye damage from eye block needles than if you only provide MAC (48 vs. 3 in claims study)

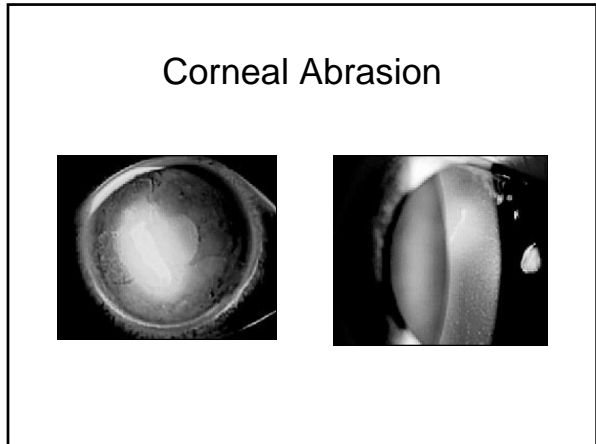
Corneal Abrasion

Stambough JL, Dolan D. J Am Acad Orthop Surg 2007; 15(3): 156-65

- Most common surgical and anesthesia-related eye injury
- Result of incomplete closure of the eyelid
- General anesthesia reduces tear formation and cornea may become dry if not protected
- May also be caused by chemical injury from surgical skin preparations or cleaning chemicals for anesthesia masks; these may also lead to scleral or corneal inflammation
- Usually self-limiting
- But, rarely an abrasion may lead to a corneal ulcer with loss of vision in affected eye

Corneal Abrasion





Corneal Abrasion

Gild WM, Posner KL, et al. Anesthesiology 1992; 76:204-8

- 35% of claims for eye injury
- Low incidence of permanent damage (16%)
- Low median payment(\$3000)
- Only able to identify cause of abrasion in 20% of cases (10% in Roth study)
- Symptoms:
 - Pain, foreign body sensation, blurred vision, photophobia, tearing, pain on blinking

Corneal Abrasion

Stambough JL, Dolan D. J Am Acad Orthop Surg 2007; 15(3): 156-65

- Prevention:
 - Tape eyes shut or use occlusive dressing
 - Check eyes frequently
 - Ointment may/may not help (Cucchiara study found no benefit)
 - In PACU, do not allow patients to rub eyes
 - Check position of oxygen facemask or nasal cannula
- Treatment:
 - Application of topical antibiotic
 - Should improve within 24 hours

Corneal Abrasion – Other Treatments

- Patching – NO
 - Patients heal faster, had less pain and blurred vision without patch
 - Kaiser PK. Ophthalmology 1995; 102(12): 1936-42
 - Wilson SA, Last A. Am Fam Physician 2004; 70(1): 123-8
 - Turner A, Rabui M. Cochrane Database Syst Rev 2006; 19(2):CD004764
- Mydriatics - NO

Corneal Abrasion – Other Treatments

- Topical non-steroidal medications (such as indomethacin 0.1% or ketorolac 0.5%) – **EQUIVOCAL**
 - May reduce need for other sedatives/analgesics, but visual analog pain scale score changes may not be clinically significant
 - Weaver CS, Terrell KM. Ann Emerg Med 2003; 41:134-140

Post-operative Visual Loss

Roth S et al, Anesthesiology 1996; 85:1020-7

- 60,965 anesthetics from 1988-1992
- Non-ocular surgery
- 34 Patients (0.056%) with eye injury, 2 patients (0.003%) with visual loss
- Only 21% of all cases had discernable cause

Post-operative Visual Loss
 Roth S et al, Anesthesiology 1996; 85:1020-7

- Independent Risk Factors:
 - Length of surgery
 - Lateral positioning
 - Operations on head or neck
 - General anesthesia
 - Surgery on Monday

Post-operative Visual Loss
 Warner ME, Anesthesia & Analgesia 2001; 93: 1417-21

- 501,342 anesthetics from 1986-1998
- 405 cases of visual loss
- 216 regained full vision within 30 days
- 189 lost vision > 30 days
 - 185 underwent ophthalmologic/neurosurgical procedure with tissue damage or loss
 - 4 without tissue damage/loss = 0.0008%

Post-operative Visual Loss
 Warner ME, Anesthesia & Analgesia 2001; 93: 1417-21

- None of 26,212 neuraxial blockade patients had visual loss
- None of 11,942 spinal surgery patients had loss > 30 days (8 had loss < 30 days)
- Data contrasts with 0.06% loss after cardiac surgery (Nuttall, 2001)

Post-operative Visual Loss
 Warner ME, Anesthesia & Analgesia 2001; 93: 1417-21

- Possible factors:
 - Anemia
 - Hypotension
 - Surgical Duration
 - Combination

Post-operative Visual Loss
 Nuttall GA et al, Anesthesia and Analgesia 2001; 93:1410-6

- Study of 27,915 patients undergoing CPB
- 17 had ION; 0.06% (12 AION, 5 PION)
- Bivariate risk factors:
 - Low Hgb conc (<8.5 g/dL)
 - Atherosclerotic vascular disease
 - Pre-operative angiogram
- Univariate risk factors
 - RBC transfusions (OR 1.3)
 - Any non-RBC product (OR 4.4)

Post-operative Visual Loss
 Patil CG, Lad EM, et al. Spine 2008; 33(13): 1491-6

- Retrospective study using National Inpatient Sample data from 1993 to 2003 undergoing spine surgery:
 - 4,728,815 patients total
 - 4134 (0.087%) had postoperative visual sx
 - 271 (0.006%) had diagnosis of ION
 - 47 (0.001%) had diagnosis of CRAO
 - Overall incidence was 0.094%

Post-operative Visual Loss

Patil CG, Lad EM, et al. Spine 2008; 33(13): 1491-6

- Highest incidence:
 - Surgery for scoliosis – 0.28%
 - Posterior-only approach – 0.29%
 - Anterior-only approach – 0.17%
- Risk factors for non-ION, non-CRAO loss:
 - Age<18 years: OR 5.8
 - Age>84 years: OR 3.2
 - Peripheral vascular disease: OR 2.0
 - Pre-existing hypertension: OR 1.3
 - Blood transfusion: OR 2.2

Post-operative Visual Loss

Patil CG, Lad EM, et al. Spine 2008; 33(13): 1491-6

- Risk factors for ION:
 - Hypotension: OR 10.1
 - Peripheral vascular disease: OR 6.3
 - Anemia: OR 5.9
- Note – this study did not define hypotension or anemia

Post-operative Visual Loss

Shen Y and Roth S, Anesthesiology 2008; 109: A1013

- Retrospective study using National Inpatient Sample from 1996 to 2005
- Rates of visual loss:
 - Spinal fusion – 1:3364 (0.029%)
 - Laminectomy – 1:11,453 (0.0087%)
 - Appendectomy – 1:78705 (0.0012%)
- Spinal fusion with visual loss:
 - 57% lumbar/lumbosacral
 - 35% thoracic/thoracolumbar
 - 8% cervical

Post-operative Visual Loss

Shen Y and Roth S, Anesthesiology 2008; 109: A1013

- Spinal fusion with visual loss:
 - 83% posterior approach**
 - Male vs. female similar
 - Younger
 - Similar co-morbidities to patients without loss

Post-operative Visual Loss Summary of Studies Reporting Incidence

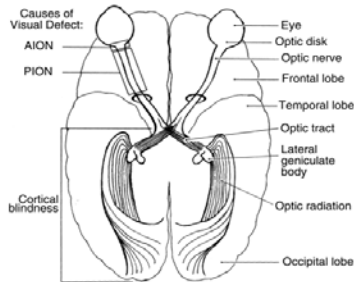
	<u>Year</u>	<u>Population</u>	<u>Incidence</u>
Roth, Thistead, et al	1996	General Surgical	0.003%
Warner, Warner, et al	2001	General Surgical	0.001%
Nuttall, Garrity, et al	2001	Cardiac	0.060%
Kalyani, Miller, et al	2004	Cardiac	0.113%
Stevens, Kelley, et al	1997	Spine	0.200%
Chang, Miller	2005	Spine	0.028%
Patil, Lad, et al	2008	Spine	0.094%
Shen, Roth	2008	Spine	0.029%

Most Common Causes

- Ischemic Optic Neuropathy (ION)
- Central Retinal Artery Occlusion (CRAO)
- Cortical Blindness
- Central Retinal Vein Occlusion

Anatomic Classification of Visual Loss

Williams EL et al; Anesth Analg 1995; 80:1018-29



AION: Anterior ischemic optic neuropathy
 PION: Posterior ischemic optic neuropathy

Ischemic Optic Neuropathy

- Anterior ischemic optic neuropathy (AION)
 - Non-arteritic (more common perioperative type)
 - Arteritic
- Posterior ischemic optic neuropathy (PION)

Vascular Supply of Anterior Optic Nerve

Williams EL et al; Anesth Analg 1995; 80:1018-29

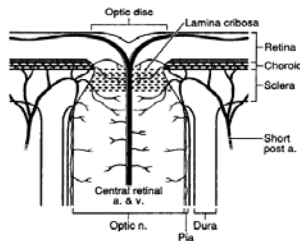


Figure 2. Diagram of the anterior optic nerve showing the arterial and small vessel supply to the choroid and optic nerve as it passes through the lamina cribrosa. Short post a = short posterior ciliary artery; a = artery; v = vein; n = nerve.

Anterior Ischemic Optic Neuropathy

- Caused by transient decrease in perfusion pressure of the nutrient vessels of the anterior optic nerve below autoregulatory range
 - Decreased mean arterial pressure
 - Increased intraocular pressure
 - Both
- Injury depends on severity and duration of transient ischemia

Anterior Ischemic Optic Neuropathy

- Presentation:
 - Painless visual loss
 - Usually in first 24-48 hours after surgery
 - Afferent pupil defect or unreactive pupils
 - Usually noted upon awakening
 - Visual field deficits (inferior) or complete loss
 - Commonly bilateral, but may be unilateral

Anterior Ischemic Optic Neuropathy

- Physical Findings:
 - Early optic disk edema
 - optic disk hemorrhages
 - Disk edema replaced by pallor in 2-3 months
- Prognosis:
 - Poor - <30% show some improvement
- Treatment:
 - None

Anterior Ischemic Optic Neuropathy – Etiology

Williams EL. Anesthesiology Clin N Am 2002; 20:367-384

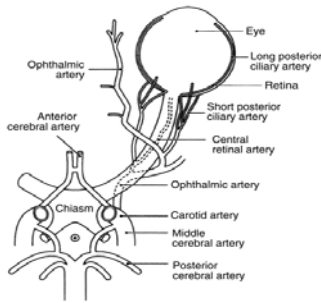
- | | |
|---|--|
| <ul style="list-style-type: none"> • Predisposing factors Variable blood supply (posterior ciliary arteries) Small optic disk size Aging Hypertension Smoking Diabetes mellitus Vascular disease | <ul style="list-style-type: none"> • Precipitating Factors Acute systemic hypotension Venous obstruction Raised intraocular pressure Lowered hematocrit Increased blood viscosity (sickle cell; polycythemia) |
|---|--|

Posterior Ischemic Optic Neuropathy

- Caused by decreased oxygen delivery to posterior portion of optic nerve (between optic foramen and where central retinal artery enters nerve)
- Nerve only fed by pial vessels which are sensitive to compression
- Not usually associated with occlusive vascular disease
- More likely to be associated with emboli than AION

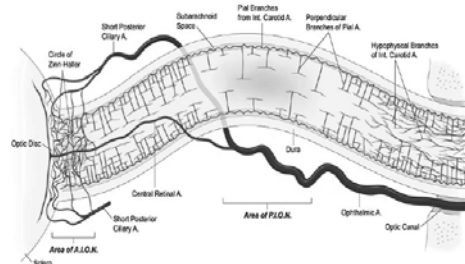
Vascular Supply of the Eye

Williams EL et al; Anesth Analg 1995; 80:1018-29



Vascular Supply of the Eye

Baig 2007



Posterior Ischemic Optic Neuropathy

- **Presentation:**
Similar to AION, but may also develop slower
- **Physical findings:**
Optic disk appears normal early
Mild disk edema days later
Orbital CT may show enlarged intraorbital optic nerve

Posterior Ischemic Optic Neuropathy

- **Prognosis:**
Poor – like AION, usually fixed deficit
- **Treatment:**
None

Posterior Ischemic Optic Neuropathy – Etiology

Williams EL. Anesthesiology Clin N Am 2002; 20:367-384

- Multifactorial:
 - Hypotension
 - Low Hemoglobin
 - Increased intraorbital venous pressure
 - Infection
 - Venous obstruction
 - Congenital absence of central retinal artery
 - Internal carotid artery dissection

Posterior Ischemic Optic Neuropathy – Risk Factors

Dunker S, Hsu HY, et al. J Am Coll Surg 2002; 194:705-710

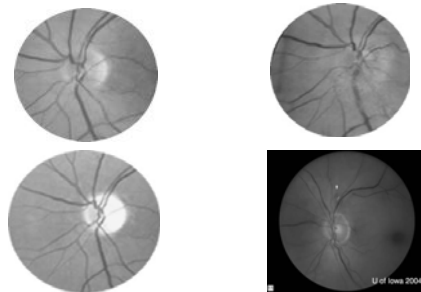
- Male
- Mean age 50 years old
- Spine surgery
- Intraoperative hypotension
- Large blood loss (2000-16,000ml)
- Drop in hematocrit of 9.5-19% (mean 14%)
- Facial swelling

Ischemic Optic Neuropathy – Visual Field Deficit



American Society of Anesthesiologists, Postoperative Visual Loss Registry

Fundoscopy



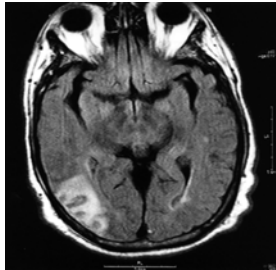
Cortical Blindness

- Caused by damage to the optic radiation or occipital cortex (resulting in infarction) from:
 - Embolism (particulate or air)
 - Sustained hypotension
 - Cardiac arrest
- Presentation:
 - Painless loss of vision, pattern depends on area affected

Cortical Blindness

- Physical findings:
 - Normal optic disk
 - Retention of pupillary reflex
 - Abnormal CT or MRI
- Prognosis:
 - Good
- Treatment:
 - Maintain Hgb and normal cerebral perfusion pressure to avoid extending damage
 - Hyperbaric O₂ if air embolism is suspected

Cortical Blindness



Non-hemorrhagic infarct in left occipital lobe
From Stambough JL, Dolan D, et al, J Am Acad Orthop Surg 2007;
15:156-165

Central Retinal Artery Occlusion

- Usually caused by compression of the eye leading to increased intraocular pressure with resultant decrease or cessation of flow in the central retinal artery
- End result is retinal ischemia due to lack of oxygen delivery

Central Retinal Artery Occlusion

- Presentation:
 - Symptom onset within 24 hours
 - Unilateral visual loss
 - No light perception
- Physical findings:
 - Afferent pupil defect
 - Periorbital edema or other trauma
 - Cherry red spot on fundoscopic exam

Central Retinal Artery Occlusion

Roth S. ASA Refresher Course Lectures 2008

- Prognosis:
 - Usually irreversible
- Treatment:
 - No consistently effective treatment
 - Acetazolamide and inhalation of 5% CO₂?
- Etiology:
 - Emboli
 - Improper positioning
 - External compression (head and neck surgery)

Post-operative Visual Loss Anatomic Considerations

- Blood supply to optic nerve is vulnerable
- Known variability in blood supply
- Atypical anatomic patterns
- Poor watershed perfusion zones
- Abnormal autoregulation
- Optimal range of hematocrit and blood pressure for adequate O₂ delivery to optic nerve unknown (particularly in presence of venous congestion in prone position)

ASA POVL Registry

- Established by ASA in June 1999
- Goal is to obtain sufficient cases (100 or more) so associations can be made and investigated
- Presently have 131 cases reported as of June 2005
- 93 Cases (71%) were spine surgery

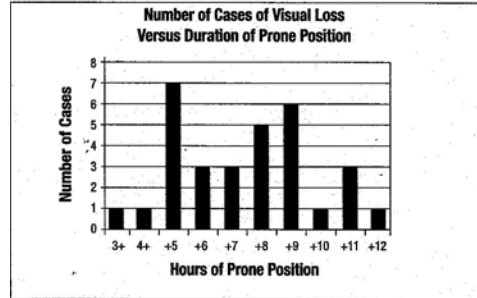
Most Common Procedures

- Spine surgery (67%)
- Cardiac surgery (10%)
- Liver transplant
- Thoraco- and abdominal aneurysms
- Head and Neck surgery
- Thoracotomy
- Others

Post-operative Visual Loss

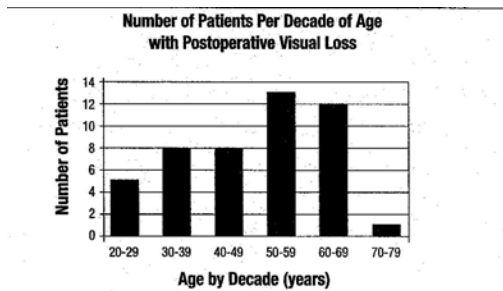
Lee LA, Anesthesia Patient Safety Foundation

Newsletter 2001; 16(4): 49-64



Post-operative Visual Loss

Lee LA, Anesthesia Patient Safety Foundation Newsletter 2001; 16(4): 49-64



Post-operative Visual Loss

Lee LA, Anesthesia Patient Safety Foundation Newsletter 2003; 18(2): 17-32

Table 1. Preliminary Data from the ASA Postoperative Visual Loss Registry: Associated Factors from Spine Cases Diagnosed with ION (N = 43)

	Median	Range
Age (yrs)	49	19 - 73
Prone Time (hrs)	8	3 - 24
Estimated Blood Loss (liters)	2.3	0.2 - 20.0
Lowest Hematocrit (%)	25.5%	19% - 40%
Largest % Decrease in BP	37%	19% - 61%
Deliberate Hypotension	17 (40%)	
Headrest:		
Mayfield Tongs	8 (18%)	
Horseshoe	0	
Foam	33 (77%)	
Unknown	2 (5%)	

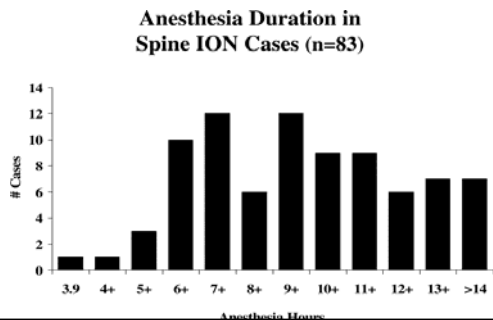
Post-operative Visual Loss

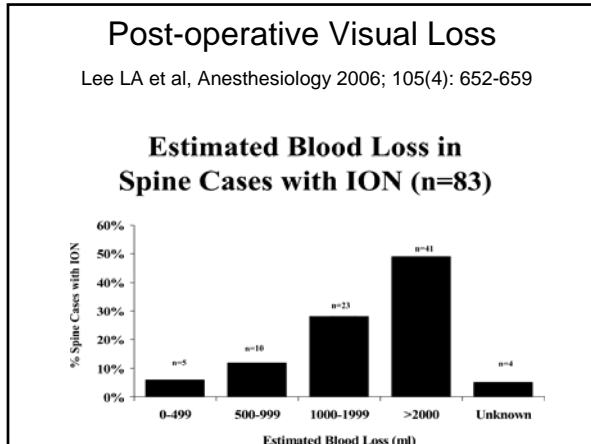
Lee LA, Anesthesia Patient Safety Foundation Newsletter 2003; 18(2): 17-32

- Most patients middle-aged (median=49)
- Long duration (median=8 hours)
- Blood pressure decreases (median=37% drop; deliberate hypotension used in 40% of cases)
- Large blood loss (median=2.3L)
- Anemia (median hematocrit=25%)
- Intraoperative course may be completely unremarkable
- 18% of patients were in Mayfield holder (ION can occur without pressure on eye)

Post-operative Visual Loss

Lee LA et al, Anesthesiology 2006; 105(4): 652-659





Post-operative Visual Loss

Lee LA et al, Anesthesiology 2006; 105(4): 652-659

Table 6. ASA POVL Registry: Lowest Blood Pressure* in Spine Cases with ION (n = 83)

	n (% of 83 cases)
Lowest SBP, mmHg	
> 110	4 (5)
101-110	7 (8)
91-100	17 (20)
81-90	35 (42)
71-80	12 (14)
≤ 70	5 (6)
Unknown	3 (4)
Lowest MAP or SBP as % below baseline, mmHg	
< 20%	5 (6)
20-39%	47 (57)
40-49%	21 (25)
≥ 50%	7 (8)
Unknown	3 (4)
Deliberate hypotension	22 (27)

* Blood pressure ranges were based on 15 min of blood pressure at a given range.
 ASA = American Society of Anesthesiologists; ION = ischemic optic neuropathy; MAP = mean arterial pressure; POVL = Postoperative Visual Loss; SBP = systolic blood pressure.

- Occurs over a wide range of reported blood pressures

Post-operative Visual Loss

Lee LA et al, Anesthesiology 2006; 105(4): 652-659

Table 4. ASA POVL Registry: Type of Surgical Frames, Tables, and Headrests in Spine Cases with ION (n = 83)

	n (% of 83 cases)
Type of surgical frame or table	
Wilson frame	25 (30)
Jackson spinal table	22 (27)
Soft chest rolls	17 (20)
Knee-chest tables	7 (8)
Other/unknown tables	12 (14)
Type of headrest	
Foam pad	47 (57)
Mayfield pins	16 (19)
Donut/gel pad	7 (8)
Other/unknown	13 (16)

ASA = American Society of Anesthesiologists; ION = ischemic optic neuropathy; POVL = Postoperative Visual Loss.

- Any type of table; any type of headrest

Post-operative Visual Loss

Lee LA et al, Anesthesiology 2006; 105(4): 652-659

Table 2. ASA POVL Registry Spine Cases with ION: Patient Characteristics (n = 83)

Demographics	n (% of 83 cases)
Age, mean (SD), yr	50 ± 14
Male	60 (72)
ASA I or II	53 (64)
ASA III	24 (29)
ASA IV	2 (2)
Emergency	3 (4)
Coexisting diseases	
Hypertension	34 (41)
Diabetes	13 (16)
Tobacco use	38 (46)
Coronary artery disease	8 (10)
Cerebrovascular disease	3 (4)
Increased cholesterol/lipids	11 (13)
Obesity	44 (53)
≥ 1 Coexisting diseases	68 (82)

American Society of Anesthesiologists (ASA) physical status data do not add up to 100% because of missing data in four cases.
 ION = ischemic optic neuropathy; POVL = Postoperative Visual Loss.

- Most patients had one or more co-existing disease, but can happen in ASA Class 1 patients also

Post-operative Visual Loss

Lee LA et al. Anesthesiology 2006; 105(4): 652-659

Table 5. Comparison of ION and CRAO Cases from the ASA POVL Registry (n = 95)

	ION (n = 83)	CRAO (n = 10)	P Value
Age, mean (SD), yr	50 (14)	46 (13)	0.34*
Anesthetic duration, mean (SD), h	9.8 (3.1)	6.5 (2.2)	0.002*
Estimated blood loss, median (range), l	2.0 (0.1-25)	0.75 (0.5-1.8)	0.001†
Crystalloid infusion, mean (SD), l	9.7 (4.7)	4.6 (1.7)	0.001*
Lowest hematocrit, mean (SD)	26 (5)	31 (6)	0.075*
Bilateral disease, number of cases (% of column)	55 (66)	0 (0)	0.001‡
Any visual recovery, number of cases (% of column)	35 (42)	2 (20)	0.11‡
Mayfield pins, number of cases (% of column)	16 (19)	0 (0)	0.001‡
Ipsilateral periorbital trauma, number of cases (% of column)	1 (1)	7 (70)	0.001‡

* † test. ‡ Mann-Whitney U test. † ‡ Z test.
 ASA = American Society of Anesthesiologists; CRAO = central retinal artery occlusion; ION = ischemic optic neuropathy; POVL = Postoperative Visual Loss.

Post-operative Visual Loss

Lee LA et al. Anesthesiology 2006; 105(4): 652-659

- Interesting Points:
 - Most patients with CRAO had evidence of ocular trauma and unilateral vision loss which suggests positioning may be at fault
 - Most patients with ION had bilateral visual loss indicating systemic or patient-specific factors may play role

**Post-operative Visual Loss
Summary of Suggested Risk Factors**

- Hypertension
- Diabetes
- Smoking
- Atherosclerosis
- Male gender
- Middle age
- Spine surgery
- Head and neck surgery
- Cardiac surgery
- Hyperlipidemia
- Intraoperative hypotension
- Intraoperative anemia
- Large blood loss
- Large fluid resuscitation
- Facial edema
- Prone position – head down
- Prolonged surgical time
- Eye trauma
- Vasopressors

**Post-operative Visual Loss:
Strategies for Prevention**

• **Proper positioning:**

Prone position with head down will cause increase in intraocular pressure and favor development of periorbital edema

Keep head above level of heart

Murphy DF. Anesth Analg 1985; 64:520-30
Cheng MA, Todorov A. et al, Anesthesiology 2001; 95:1351-5
Draeger J, Hanke K. Ophthalmic Res 1986; 18:55-60
Friberg TR, Weinreb RN. JAMA 1985; 253:1755-7

Use padded headrest without pressure on eyes

**Post-operative Visual Loss:
Strategies for Prevention**



**Post-operative Visual Loss:
Strategies for Prevention**

- Occlusive dressing over eyes to prevent entry of surgical prep solutions
- Avoid hypotension
- Avoid anemia
- Stage long procedures into two or more short procedures

Endorsed by North American Neuro-Ophthalmology Society and North American Spine Society

- Avoid large volume resuscitation if possible

**Post-operative Visual Loss:
Strategies for Prevention**

Patil CG, Lad EM, et al. Spine 2008; 33(13): 1491-6

- Avoid direct pressure on globe
- Avoid perioperative hypotension
- Avoid perioperative anemia
- Consider 10 degrees of reverse trendelenberg during prone surgery
- Lower transfusion threshold to keep hematocrit above 30 in high risk patients,
- Avoid infusions of large amounts of crystalloid
- Consider staging long spinal surgeries (greater than 8 hours)
- Maintain mean arterial pressure at patient's baseline
- Perform a postoperative visual exam as early as possible in high risk patients

**So What is the ASA
Consensus?**

ASA Practice Advisory for Perioperative Visual Loss Associated with Spine Surgery Anesthesiology 2006; 104: 1319-28

Table 1. Summary of the Advisory

- There is a subset of patients who undergo spine procedures while they are positioned prone and receiving general anesthesia that has an increased risk for development of perioperative visual loss. This subset includes patients who are anticipated preoperatively to undergo procedures that are prolonged, have substantial blood loss, or both (high-risk patients).
- Consider informing high-risk patients that there is a small, unpredictable risk of perioperative visual loss.
- The use of deliberate hypotensive techniques during spine surgery has not been shown to be associated with the development of perioperative visual loss.
- Colloids should be used along with crystalloids to maintain intravascular volume in patients who have substantial blood loss.
- At this time, there is no apparent transfusion threshold that would eliminate the risk of perioperative visual loss related to anemia.
- High-risk patients should be positioned so that their heads are level with or higher than the heart when possible. In addition, their heads should be maintained in a neutral forward position (e.g., without significant neck flexion, extension, lateral flexion, or rotation) when possible.
- Consideration should be given to the use of staged spine procedures in high-risk patients.

Viagra and Vision Loss

- Sildenafil prescribed to over 27 million worldwide
- Works through nitric oxide-cyclic GMP pathway
 - May alter perfusion of optic nerve head
- PDE6 inhibitor
 - Located in rod and cone photoreceptors
 - May lead to blue tinge, blurriness, or brightness of vision
- 1:8893 may experience non-arteritic AION
- Those with history of MI (OR 10.7) and hypertension (OR 6.9) increased risk

Viagra and Vision Loss

- Recommendation that sildenafil (and perhaps tadalafil?) be discontinued for 1 week prior to surgery

Fodale V, DiPietro R, et al. Medical Hypotheses 2007; 68:880-882
McGwin G, Vaphiades MS, et al. Br J Ophthalmol 2006; 90:154-157

References

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- Lee LA. POVL Registry Reports Preliminary Data. Anesthesia Patient Safety Foundation Newsletter 18:21, 2003
- Lee LA et al. The American Society of Anesthesiologists postoperative visual loss registry: Analysis of 93 spine surgery cases with postoperative visual loss. Anesthesiology 2006; 105: 652-9