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Preventive interventions for rising intraocular pressure: Validation & development of an observation scale (MBOS)

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Background: Following a case of postoperative visual loss (POVL) in the steep Trendelenburg (ST) position at our institution, IOP measurements were taken during laparoscopic surgery. IOP was observed to rise overtime with increases (4-5 times baseline). While monitoring we observed eyelid edema, conjunctival edema (chemosis), ecchymosis, and facial edema and hypothesized that findings were correlated to rising IOP. We trialed apreventive supine intervention that significantly impacted increase in IOP and may potentially preventfuture (POVL) events since current literature cites retinal cell ganglion dysfunction as a result of evenbrief acute increases in IOP. Additionally, increased peri-orbital swelling and venous congestion secondary to trabecular meshwork dysregulated pressure dependent outflow may produce a low perfusion state in the eye, via a compartment syndrome mechanism. CosoptTM (Timolol/Dorzolamide) eye drops were trialed since this drug has dual action as a carbonic anhydrase inhibitor and a beta adrenergic blocker. Prevention of IOP rising above 40 mmHg was the goal in these studies since 45-55 mmHg IOP was determined to be a critical threshold in POVL incidents. The aim was to provide an observation scale that enables theanesthesia caregiver to gage timing of intervention so as to prevent increases in IOP. Cosopt trial analysis showed statistical significance in comparison to ST group. Findings of eyelid edema correlated to a 2.5 times increase inbaseline IOP. Findings of chemosis correlated to a 3.4 times increase. An additional study site was used to generalize and validate initial findings and to increase sample size.

Methods: The study design was a prospective repeated measure regression model. Patients undergoing ST position surgery were enrolled in 2 hospitals in CT. Patients, IOP and presence of eyelid edema and chemosis measured by MBOS were recorded at the start of surgery and at 30, 60, 90, and 120 minutes throughout the surgery. Multivariate logistic regression analysis using the generalized estimating equations (GEE) method was employed. A receiver operating characteristics curve (ROC) was used to determine the accuracy of the MBOS in diagnosis of IOP at the cutpoint of 40 mmHg.

Results: A total of 192 patients, 92 (48%) males and 100 females (52%) were recruited in the study. Mean age was 57±11 (range: 32-76) years old. Mean IOP values were 13.14±4.88 mmHg at flat position (initial time), 23.77±6.79 mmHg at 30 min, 27.60±6.99 mmHg at 60 min, 30.35±6.74 mmHg at 90 min, 31.42±7.50 mmHg at 120 min, and 20.74±6.83 mmHg at final flat position. In the final analysis, 717 observation time points in TBURG position throughout 30 to 120 minutes surgery were analyzed. EE occurred in 69% (495/717) of observations, CE occurred in 40.3% (289/717) observations. When CE occurred, IOP levels were significantly higher (32.35±7.00 mmHg) compared with IOP levels without CE occurred (25.17±6.49 mmHg), $p<0.001$. During the surgery, 93.3% (669/717) of IOP observations were <40 mmHg and 6.7% (48/717) observations were ≥40 mmHg. Patients with ≥40 mmHg IOP compared with patients with <40 mmHg, were older (62.80±8.51 vs. 56.35±10.61 yrs old), had higher baseline IOP (14.79±4.81 vs. 13.05±4.87 mmHg), and had higher BMI (33.09±7.70 vs. 30.48±8.19), $p<0.05$ respectively. When IOP values were <40 mmHg, 66.8% (n=447/669) observations had EE and 36.3% (n=243/669) had CE; and when IOP values were ≥40 mmHg, 100% (n=48/48) observations had EE and 95.8% (46/48) had CE, and Chi-square tests were $p<0.001$ respectively. In the GEE analysis, eyelid edema was removed as an independent variable due to co-linearity between EE and CE. The GEE results showed that CE was a significant predictor of ≥40 mmHg IOP, $p<0.001$ and IOP was also a predictor, $p=0.056$. The ROC analysis showed that CE, EE, and IOP baseline were significant predictors for IOP ≥40 mmHg. The AUC value was 0.80 (SE=0.02) by the presence of CE alone and was 0.86 (SE=0.02) by the multivariate effects of the three predictors.

Conclusion/Implication: Current study results were generalized with expansion of study population at the original site and inclusion of another unaffiliated site. AUC value increased to 0.80 (SE=0.02) from original AUC of .79 with presence of chemosis as most statistical finding in determining critical threshold IOP ≥40 mmHg had been reached. Additionally covariates have been determined to be increased age, increased BMI and elevated baseline IOP. When a baseline IOP is available the probability of reaching the critical threshold can be assessed using the MBOS prior to surgery. Eye drop interventions can be administered at that time or at any time point when chemosis is observed. Thus, observed findings of eyelid edema and chemosis have significantly correlated to increasing IOP. Anesthesia caregivers can assess need for interventions when observing the facial changes in lieu of performing tonometry. Maintaining a normal intraocular pressure is the primary goal in pursuit of maintaining optimum ocular perfusion and potentially preventing against a future POVL event.

Biography

Bonnie Molloy PhD,CRNA is a Quality/Risk Manager and Research Director of Bridgeport Anesthesia Associates at Bridgeport Hospital of the Yale network. She earned her PhD from the University of Connecticut-Storrs. She presently is the Chief Certified Registered Nurse Anesthetist (CRNA) in the Bridgeport Anesthesia Associates practice as well as a clinical faculty member for the Fairfield University Doctor of Nursing Practice Program. She has received the Discovery of Distinction Award for her research in Postoperative Visual Loss (POVL) and Intraocular Pressure (IOP) Monitoring and has presented her findings at the ASA, PGA, IARS, AANA assemblies as well as Harvard and Yale grand round forums. She has published in the American Journal of Nurse Anesthesia and Journal of Anesthesiology and Clinical Science.

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