MULTIFACTORIAL APPROACH TO IMPROVING PERFORMANCE OF THE NOVICE VITREORETINAL SURGEON: IMPLICATIONS IN SURGICAL PRACTICE

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Purpose:
To quantitatively analyze the surgical performance of in-training vitreoretinal surgeons following exposure to propranolol, alcohol, physical activity, or polysomnographic recorded sleep interruption.

Methods:
We conducted a cross-sectional study with 15 vitreoretinal fellows with less than 2 years of surgical experience. Surgical performance using the Eyesi simulator (VRmagic, Mannheim, Germany) was quantitatively assessed after each exposure on 4 nonsequential days, as follows: day 1: placebo, 0.2 mg/kg propranolol, and 0.4 mg/kg propranolol (total=0.6 mg/kg). Day 2: baseline simulation, wine consumption with breathalyzer reading of 0.06-0.10% of blood alcohol concentration (BAC), followed by 0.11-0.15% BAC. Day 3: baseline simulation, 4 series of push-ups with 50% of maximum repetition (RM) training load, followed by 4 series of push-ups with 85% RM. Day 4: sleep restriction of 3 hours of total time in bed. The Eyesi surgical simulator was used to obtain total surgical score, task completion time (minutes), tool-tip intraocular trajectory (mm), and tremor-specific task score. The data was analyzed using the Friedman test with the Bonferroni’s adjustment for multiple comparison and the Wilcoxon test for paired comparison and p-value was set at 0.05.

Results:
The simulated surgical performance worsened with increasing alcohol exposure, as measured by total score ($X^2=7$, df=2, p=0.03) and intraocular trajectory ($X^2=6.86$, df=2, p=0.03). BAC of 0.06-0.10% and 0.11-0.15% worsened performance compared to improvement after 0.6 mg/kg and 0.2 mg/kg propranolol, respectively, in terms of total score (delta= -22 vs. delta= +13, p=0.02; delta= -43 vs. delta= +23, p=0.01); anti-tremor task score (delta= -7.5 vs. delta= +5, p=0.008; delta= -15 vs. delta= +8, p=0.009), and task completion time (delta= -0.05 min vs. delta= -1.35 min, p=0.008; delta= +0.46 min vs. delta= -0.83 min, p=0.009). Intraocular trajectory was negatively impacted by 0.11-0.15% BAC compared to 0.2 mg/kg propranolol (delta= +204.84 mm vs. delta= -221.7 mm, p=0.006). No changes were observed in surgical performance after 4 series of push-ups with 85% RM or following sleep restriction of 3 hours in bed.

Conclusions:
Alcohol exposure worsened overall surgical performance in a dose dependent manner. Propranolol 0.2 mg/kg positively affected surgical dexterity compared to alcohol levels of 0.06-0.10% BAC.