Q&A

CITATION: Nelson T. Post-alcohol consumption cognitive performance. *APSF Newsletter*. 2024;39:6.

Post-Alcohol Consumption Cognitive Performance

by Todd Nelson, MD

To the Editor:

For passenger safety and pilot performance, The Federal Aviation Administration (FAA) has several recommendations regarding alcohol consumption for pilots.[1] A few are listed below.

1. As a minimum, adhere to all the guidelines of 14 CFR Part 91.17:
   - 8 hours from "bottle to throttle"
   - Do not fly while under the influence of alcohol
   - Do not fly while using any drug that may adversely affect safety
2. A more conservative approach is to wait 24 hours from the last use of alcohol before flying. This is especially true if intoxication occurred or if you plan to fly Instrument Flight Rules. Cold showers, drinking black coffee, or breathing 100% oxygen cannot speed up the elimination of alcohol from the body.
3. Consider the effects of a hangover. Eight hours from "bottle to throttle" does not mean you are in the best physical condition to fly or that your blood alcohol concentration is below the legal limits.

Further, the FAA guidelines mandate the removal from duties of any employee performing a safety-sensitive function whose breath alcohol concentration is above 0.04 on a required alcohol test or who uses alcohol in a way that violates FAA guidelines. Temporary removal from performing safety-sensitive functions is directed if breath alcohol concentration registers between 0.02–0.039 on a required alcohol test. For reference, in the United States, a standard drink typically contains approximately 14 to 15 grams of alcohol, which is equivalent to about 0.5 to 0.6 fluid ounces. This amount is roughly equivalent to consuming a 12-ounce beer, a 5-ounce glass of wine, or a 1.5-ounce shot of 80-proof liquor. Two standard drinks are sufficient to produce a blood alcohol level of 0.04 in a 180-pound male.[2]

The American Society of Anesthesiologists Guidelines for Occupational Health and Wellness does not appear to address the issue of alcohol intake as it pertains to patient safety and anesthesia professional performance.[3] Following a night of heavy alcohol consumption psychomotor speed, short-term memory, long-term memory, and sustained attention suffer the next day.[4] These deficits in cognitive processing are more pronounced when attention is divided and when there are competing mental demands.[5]

Moreover, the consumption of alcohol is associated with an increased risk of sleep apnea and a decline in sleep quality, both of which can significantly impact cognitive function.[6,7]

Given the detrimental after-effects of alcohol consumption on cognitive performance, anesthesia professionals should seek societal recommendations that address an alcohol abstinence window before engaging in anesthetic care of patients (i.e., time from "glass to mask"). Should on-the-job random alcohol breath tests for anesthesia professionals involved in safety-sensitive patient care functions be implemented in routine practice?

Todd Nelson, MD, is a staff anesthesiologist at Memorial Hospital, Colorado Springs, CO, USA.

The author has no conflicts of interest.

REFERENCES

1. Federal Aviation Administration. Alcohol & flying: a deadly combination. https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/alcohol.pdf Accessed July 30, 2023.
2. Mukamel KJ. Overview of the risks and benefits of alcohol consumption. https://www.uptodate.com/contents/overview-of-the-risks-and-benefits-of-alcohol-consumption?search=blood%20alcohol%20concentration&source=search_result&selectedTitle=4~150&usage_type=default&display_rank=4#H158926803 Accessed July 30, 2023.
3. American Society of Anesthesiologists. https://www.asahq.org/standards-and-practice-parameters/resources-from-asa-committees Accessed July 30, 2023.
4. Gunn C, Mackus M, Griffin C, et al. A systematic review of the next-day effects of heavy alcohol consumption on cognitive performance. *Addiction.* 2018;113:2182–2193. PMID: 30144191.
5. Ayre E, Benson S, Garrisson H, et al. Effects of alcohol hangover on attentional resources during a verbal memory/psychomotor tracking dual attention task. *Psychopharmacology (Berl).* 2022;239:2695–2704. PMID: 35543714.
6. Simou E, Britton J, Leonardi-Bee J. Alcohol and the risk of sleep apnoea: a systematic review and meta-analysis. *Sleep Med.* 2018;42:38–46. PMID: 29458744.
7. Thakkar MM, Sharma R, Sahota P. Alcohol disrupts sleep homeostasis. *Alcohol.* 2015;49:299–310. PMID: 25499829,

More Q&A

CITATION:Fitzsimons MG. In response to: post-alcohol consumption cognitive performance. *APSF Newsletter.* 2024;39:6–8.

In Response To: Post-Alcohol Consumption Cognitive Performance

by Michael G. Fitzsimons, MD

The author, Todd Nelson, MD, is to be commended for raising the issue of performance of anesthesia after consumption of alcohol in this issue of the *APSF Newsletter.*

Alcohol abuse or dependence occurs in 12.9% of male physicians and 21.4% of female physicians and the incidence may be increasing.[1,2] Anesthesia professionals are not immune to alcohol abuse or dependence, but they are not necessarily at higher risk.[2] Anesthesia professionals work in an environment that constantly requires pattern recognition, rapid situational assessment, prompt physical response, and judgment based upon experience and memory. It is incomprehensible that any health care provider can argue that it is acceptable to provide anesthesia care while under the acute effects of alcohol or while legally intoxicated. What is unclear is when performance in a safety-sensitive area can be resumed after consumption of alcoholic beverages. Default to the Federal Aviation Administration (FAA) guidelines to assure patient safety and compliance of anesthesia professionals is a reasonable place to start discussions, but several weaknesses need to be addressed.[3] The guidelines and their development have been discussed in detail in two articles.[4,5]

The rule of eight hours "bottle to throttle" was suggested in 1966 and formalized in 1970.[4] The foundation upon which this rule is grounded is unclear and appears to be arbitrary. The rule is subject to individual compliance and is not based upon the amount of alcohol consumed or whether the individual is still under the influence of alcohol, whether other recreational substances were consumed, or the impact of factors such as sleep, just the passing of eight hours of time. It may be assumed that pilots will regulate their alcohol consumption prior to duty to assure that they will not be affected at the eight-hour mark, but the ability to assess impairment is inconsistent. The National Institute on Alcohol Abuse and Alcoholism has defined levels of alcohol use.* Drinking in moderation is considered alcohol consumption of no more than two drinks a day for males and one drink a day for females.[6] Binge drinking is defined as consuming five or more drinks by a male and two or more drinks by a female in two hours. Those who binge drink more than five days a month are classified as heavy drinkers.[7] None of these levels define safety after consumption and the guidelines stress that less alcohol is better for long-term health. Although moderate drinkers can be taught to estimate their blood alcohol concentration (BAC) with a reasonable degree of accuracy, heavy drinkers and alcoholics do not have the same degree of success.[8] The study by Ross and Ross in 1990 revealed that pilots overestimate the amount of alcohol necessary to achieve a certain BAC and underestimate the time of elimination of the alcohol.[9] The rule also assumes that personal impairment is recognized.

The second limitation of the guidelines relates to the established levels of BAC and whether this is impactful under normal circumstances and applies to adoption in a widespread policy. The FAA has established a BAC of 0.04 in a blood or breath alcohol specimen (FAA guidelines). This rule was established in the 1980s after years of resistance based largely upon the notion that only a small number of aviation accidents were associated with alcohol use.[4] This level is lower than the 0.08 level established by states for operation of motor vehicles.[10] Some states have even lower levels for commercial vehicle operators or minors. Operating under higher levels may trigger enhanced penalties. The FAA established level is lower than that defined as legal intoxication for motor vehicle operation and adds a theoretical extra margin of safety. The logistic problem with the FAA BAC requirement is that although commercial pilots are subject to random, reasonable suspicion, post-accident, return to duty, and follow-up drug testing, they are not subject to testing prior to all flight duties as a matter of routine. There are many reports of pilots demonstrating obvious impairment and subsequently being removed from duty. Subtle presentations of impairment may go undetected. Even obvious behaviors consistent with impairment must be reported by an observer for testing to occur. If pilots are like health care professionals, there is a high likelihood that they would not report an impaired colleague, especially if certainty is lacking. Nearly one-third of physicians would not report an impaired medical colleague.[11] Although more anesthesiology departments are instituting drug testing, none have reported their mechanisms or processes to test for acute impairment by alcohol.[12-15] Another challenge specific to breath alcohol testing is that to maintain standards to the level of the Department of Transportation (DOT), individuals must maintain certification as a Breath Alcohol Technician (BAT) or Screening Test Technician (STT).[16] This requirement may limit an institution's ability to perform tests or require the use of the more invasive blood alcohol testing.

The third limitation of the FAA guidelines relates to the notion that even if eight hours have passed since the last consumption of alcohol, and the BAC is less than 0.04, then it is assumed that performance has returned to a level equal to that prior to any alcohol consumption. This current guidance suggests to "consider the effects of hangover," a recommendation which is purely subjective and up to the discretion of the individual. Hangover is defined as a combination of negative mental and physical symptoms that persist into the day after heavy alcohol consumption even though the blood alcohol concentration approaches zero.[17] Symptoms may include fatigue, nausea, headache, weakness, and sound sensitivity.[18] Several different scales have been suggested for estimating hangover effects including the Hangover Symptoms Scale (HSS), the Acute Hangover Scale (AHS), and the Alcohol Hangover Severity Scale (AHSS). These scales generally underestimate hangover severity, bringing into question their value.[18] Howland et al. determined that 76% of individuals who consumed to a level of intoxication reported mild to moderate hangover.[19] Verster has suggested updating the definition of hangover by removing the criteria of "heavy alcohol consumption" based on data that show hangover can occur at levels far below that meeting legal intoxication.[20]

Numerous studies have examined the impact alcohol consumption the prior evening has on performance of daily activities (e.g., driving) the following day. Many of these studies have addressed performance when the BAC is near or at zero. Alford et al. compared simulated driving performance before alcohol consumption and then on the day after consumption.[21] On the day after consumption, half of the participants had a BAC of 0% (zero alcohol group) and half

See "Q&A: Response to Post-Alcohol," Next Page

More Q&A

In Response To: Post-Alcohol Consumption Cognitive Performance (cont'd)

From "Q&A: Response to Post-Alcohol," Preceding Page

had residual alcohol (0.01–0.08). Individuals with hangover, but zero BAC had similar impairment of many simulated driving variables including response times, excursions from lane, and time off the road. The conclusion of the study was that whether residual alcohol was present or not, the pattern of impairment was similar in patients with hangover.[21] The study also revealed that individuals are not always aware of their level of impairment. The amount of alcohol consumed was not reported. Scholey et al. studied the impact of hangover on cognitive performance.[22] The study evaluated executive performance after a night of heavy alcohol consumption (average number of drinks 13.5). Cognitive function and working memory were impaired during hangover and were associated with the previous night's BAC alcohol level. McKinney and Coyle revaluated memory and psychomotor performance when alcohol levels were zero or very near zero after a normal night of alcohol consumption.[23] The average alcohol consumption during a normal night of drinking was more than ten units (drinks) the night prior to testing. Both performance measures were impaired at 9:00 AM the next morning despite the zero or very near zero alcohol levels.[23] The study by Ayre et al. mentioned by the author Nelson in this issue of the *APSF Newsletter*, noted cognitive function impairment during hangover when participants consumed more than eight drinks the evening prior to testing.[24] Interpretation of studies regarding the impact of alcohol on performance must be made with caution due to design variances including amount, frequency of consumption, timing in relation to assessment, gender, differences in metabolism, binge drinking versus social drinking, and concurrence of dependence or abuse.[25] Additionally, other factors such as the impact of sleep disturbance associated with alcohol use should be considered.[26] More sleep disturbances such as number of night awakenings, duration of night awakenings, total sleep time, and poorer sleep quality were associated with alcohol consumption and resulted in higher hangover severity as well as poorer cognitive performance the day afterwards.

CONCLUSIONS AND RECOMMENDATIONS

Alcohol levels below legal intoxication and the residual condition of "hangover" have a negative impact on performance. Although guidelines exist for individuals in safety-sensitive positions such as aviation, they have not been formalized in the specialty of anesthesiology. Application of current FAA guidelines to anesthesiology ignores weaknesses of those guidelines including an arbitrary time from "glass to mask" in the eloquent words of Nelson, the subjective nature of hangover, reliance on self-policing to initiate alcohol testing, and logistic limitations of alcohol testing.

Anesthesia professional societies should take the recommendations of Nelson and others as a challenge to develop guidelines for the performance of anesthesia after the use of recreational substances beginning with alcohol, but ultimately including other recreational substances. Such guidelines should address time from "glass to mask," the role of substance screening including pre-placement, under conditions of reasonable suspicion for impairment, and after a significant critical event when a provider is suspected of compromise. Practicing anesthesia personnel and trainees in residency and fellowships should undergo required education on the impact of these substances on our performance and include behaviors, which indicate impairment by recreational or controlled substances. Routes to obtain confidential personal care for individuals with substance use disorders should be outlined. Mechanisms to report impairment by colleagues should be clear.

Substances primarily utilized for recreation such as alcohol impact our ability to perform the core responsibilities of our critical role as stewards of safety. It is imperative that education include the unpredictable effects residual recreational substances have on performance. It is our responsibility to develop policy regarding the use of these substances as well as design systems which enhance our ability to assure objective oversight.

Michael G. Fitzsimons, MD, is associate professor at Harvard Medical School and director, Division of Cardiac Anesthesia in the Department of Anesthesia, Critical Care, and Pain Medicine at Massachusetts General Hospital, Boston, MA. He is also chairperson, ASA Advisory Panel on Substance Use Disorders Prevention. The opinions expressed are his alone.

The author has no conflicts of interest.

REFERENCES

1. Oreskovich MR, Shanafelt T, Dyrbye LN, et al. The prevalence of substance use disorders in American physicians. *Am J Addict.* 2015;24:30–38. doi: 10.1111/ajad.12173. PMID: 25823633.
2. Wilson J, Tanuseputro P, Myran DT, et al. Characterization of problematic alcohol use among physicians: a systematic review. *JAMA Netw Open.* 2022;5:e2244679. PMID: 36484992.
3. Federal Aviation Admiinistration. Alcohol & flying: a deadly combination. https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/alcohol.pdf Accessed December 13, 2023.
4. Schofield DU. Knowing when to say when: federal regulation of alcohol consumption by air pilots, *J Air L & Com.* 1992;937:937–979. https://scholar.smu.edu/cgi/viewcontent.cgi?article=1963&context=jalc
5. Modell JG, Mountz JM. Drinking and flying—the problem of alcohol use by pilots. *N Engl J Med.* 1990;323(7):455-461. PMID: 2197554.
6. National Institute on Alcohol Abuse and Alcoholism. Acohol's effects on health. https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking Accessed July 7, 2023.
7. Substance Abuse and Mental Health Services Administration. Substance use disorders. https://mm.nh.gov/media/dhhs-trainings/sud-training/presentation_content/external_files/Substance%20Use%20Disorders%20_%20SAMHSA.pdf Accessed July 7, 2023.

[1]Levels are defined as grams of alcohol per deciliter of blood or grams of alcohol per 210 liters of breath (Code of Federal Regulations).

See "Q&A: Response to Post-Alcohol," Next Page

More Q&A

In Response To: Post-Alcohol Consumption Cognitive Performance (cont'd)

From "Q&A: Response to Post-Alcohol," Preceding Page

8. Aston ER, Liguori A. Self-estimation of blood alcohol concentration: a review. *Addict Behav.* 2013;38: 1944–1951. PMID: 23380489.
9. Ross SM, Ross LE. Pilots' knowledge of blood alcohol levels and the 0.04% blood alcohol concentration rule. *Aviat Space Environ Med*. 1990;61:412–417. PMID: 2350310.
10. World Population Review. BAC limit by state 2023. https://worldpopulationreview.com/state-rankings/bac-limit-by-state Accessed July 7, 2023.
11. DesRoches CM, Rao SR, Fromson JA, et al. Physicians' perceptions, preparedness for reporting, and experiences related to impaired and incompetent colleagues. *JAMA*. 2010;304:187–193. doi: 10.1001/jama.2010.921. PMID: 20628132.
12. Fitzsimons MG, Baker KH, Lowenstein E, Zapol WM. Random drug testing to reduce the incidence of addiction in anesthesia residents: preliminary results from one program. *Anesth Analg.* 2008;107:650–655. PMID: 18633044.
13. Fitzsimons MG, Baker K, Malhotra R, et al. Reducing the incidence of substance use disorders in anesthesiology residents: 13 years of comprehensive urine drug screening. *Anesthesiology.* 2018:129:821–828. PMID: 30020101.
14. Tetzlaff J, Popa D. A strategy to prevent substance abuse in an academic anesthesiology department. *J Clin Anesth.* 2010;22:143–150. PMID: 20304360.
15. Rice MJ, Grek SB, Swift MD, et al. The need for mandatory random drug testing in anesthesia providers. *Anesth Analg.* 2017;124:1712–1716. PMID: 28207591.
16. U.S. Department of Transportation. How to become a breath alcohol technician and screening test technician. https://www.transportation.gov/partners/drug-and-alcohol-testing/how-become-breath-alcohol-technician-and-screening-test-technician Accessed July 7, 2023.
17. Van Schrojenstein Lantman M, van de Loo AJ, Mackus M, et al. Development of a definition for the alcohol hangover: consumer descriptions and expert consensus. *Curr Drug Abuse Rev*. 2016;9:148–154. PMID: 28215179.
18. Verster JC, van de Loo AJAE, Benson S, et al. The assessment of overall hangover severity. *J Clin Med.* 2020;9:786. PMID: 32183161.
19. Howland J, Rohsenow DJ, Allensworth-Davies D, et al. The incidence and severity of hangover the morning after moderate alcohol intoxication. *Addiction.* 2008;103:758–765. PMID: 18412754.
20. Verster JC, Scholey A, van de Loo AJAE, et al. Updating the definition of the alcohol hangover. *J Clin Med*. 2020;9:823. PMID: 32197381.
21. Alford C, Broom C, Carver H, et al. The impact of alcohol hangover on simulated driving performance during a 'commute to work'-zero and residual alcohol effects compared. *J Clin Med*. 2020;9:1435. PMID: 32408588.
22. Scholey A, Benson S, Kaufman J, et al. Effects of alcohol hangover on cognitive performance: findings from a field/internet mixed methodology study. *J Clin Med.* 2019;8:440. PMID: 30935081.
23. McKinney A, Coyle K. Next day effects of a normal night's drinking on memory and psychomotor performance. *Alcohol Alcoholism.* 2004;39:509–513. PMID: 15477234.
24. Ayre E, Benson S, Garrisson H, et al. Effects of alcohol hangover on attentional resources during a verbal memory/psychomotor tracking dual attention task. *Psychopharmacology (Berl).* 2022;239:2695–2704. PMID: 35543714 .
25. Thørrisen MM, Bonsaksen T, Hashemi N, et al. Association between alcohol consumption and impaired work performance (presenteeism): a systematic review. *BMJ Open.* 2019;9:e029184. doi: 10.1136/bmjopen-2019-029184.
26. Ayre E, Scholey A, White D, et al. The relationship between alcohol hangover severity, sleep and cognitive performance; a naturalistic study. *J Clin Med*. 2021;10:5691. PMID: 34884392.