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Evaluating Fitness to Perform in Surgical Residents after Night Shifts and Alcohol Intoxication: The development of a "Fit-to-Perform" test

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OBJECTIVE: To develop a self-test to measure clinical fitness to perform in surgical residents, with alcohol-induced impairment as reference.

DESIGN: Observational, exploratory study to evaluate night shift-induced impaired performance in surgical residents followed by a randomized blinded, placebo-controlled, crossover study to evaluate impaired performance as a result of ethanol intoxication. Impairment was quantified using the Mini-NeuroCart, a psychomotor and cognitive test battery for assessment of subjective and objective measures of alertness, concentration, eye-hand coordination, mood, and self-assessed ability to perform. Surgical performance was tested in the randomized study with a laparoscopy surgical trainer.

SETTINGS: Level-I trauma hospital and a clinical research unit.

PARTICIPANTS: Surgical residents ($n = 12$ for the observational study, $n = 18$ for the randomized study).

RESULTS: High alcohol levels (0.6 g L^{-1}) impaired adaptive tracking, reduced objective and subjective alertness, and increased slowness. Moreover, laparoscopy depth perception was impaired in the 0.6 g L^{-1} group. No significant within-subject correlation between subjective and objective measures of alertness was found. Performance of postcall surgeons was similar to, or even worse than, the performance of intoxicated surgeons.

CONCLUSIONS: The Mini-NeuroCart detected ethanol-induced performance effects that were similar to the effects of working a 14-hour night shift. Social (ethanol), personal (mood), and professional (laparoscopic skills) standards of fitness can in this manner be related to accepted deleterious effects of alcohol. The Mini-NeuroCart is, therefore, a potential noninvasive test for assessing "fitntness to perform" in healthcare professionals. (J Surg Ed ▮:▮▮▮-▮▮▮. © 2018 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEYWORDS: Fatigue, performance, work hour reform, work hour limits, surgical training, physician burnout

COMPETENCIES: Performance, Surgery, Residents, Burnout

INTRODUCTION

Over the past 30 years, there has been an intense debate on the relation between physician's fatigue and patient safety.[1,2] A serious adverse event[3] in the early 1980s led to the first governmental interventions and work-hour directives in the European Union and the United States.[3] As then, political pressure led to several adjustments of work-hour directives, with inevitable difficulties in work scheduling and resident training programs.[4,5] However, there is an absence of objective data to support these changes[6] and there is no validated objective tool to measure the effect of these reforms. This paucity of data could also be the cause of conflicting reports on the safety of care provided by "fatigued physicians."[7,8] Moreover, maximum resident working hours range from 48 hours in Europe up to 80 hours in the United States, indicating that the evidence supporting these approaches is either absent or at

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least interpreted in an inconsistent manner.[9] Several reports have been published about central nervous system (CNS) impairment after working nights or odd shifts, but these studies generally focus on a single aspect of CNS function,[10] use tests that are not suitable for practical use or lack a relevant frame of reference. Therefore, there is need for objective "fitness to perform" standards among healthcare professionals.

Ideally, a "fit-to-perform" test would be a fast and portable self-assessment that combines objective and subjective performance measures and provides an indication of actual performance relative to social, legal, personal, and professional reference frames. In this study we chose to use a battery of tests that was extensively tested to evaluate the effects on CNS performance of new and existing medicines, alcohol[11] and sleep deprivation.[12,13] This battery of tests was in itself too large for more extensive field testing in medical settings and therefore required a reduction in the number of tests to those most responsive to fatigue. This was done in an observational exploratory study.

We then evaluated in a laboratory setting how these effects relate to alcohol-induced impairment in surgical residents. Previously, a correlation was shown between performance decrement due to sleep deprivation and due to alcohol intoxication.[11] This offers the opportunity to establish a social frame of reference as legal limits have been set for maximum blood alcohol content related to public road safety. Additionally, we attempted to relate these effects to a quantitative measure of surgical laparoscopic performance to provide a professional frame of reference. By using an objective testing instrument and creating relevant frames of reference, this study aimed to provide a self-assessment tool of fitness to work for healthcare professionals and to offer ground for cut-off values. We hypothesized that postcall performance resembles performance under influence of ethanol, and that this decrease would lead to impaired surgical skills.

METHODS

Design

Observational Study

Twelve surgical residents were assessed before, during, and after night duty in a Level-I trauma center using the fully equipped NeuroCart test battery.[14,15] Cognitive and psychomotor impairment was observed in several tests, which potentially could be used for assessment of impairment caused by fatigue in larger studies. Results from this exploratory research formed the basis for the main study.

Randomized Study

This was a single blind, placebo-controlled randomized 3-way crossover study in which the effects of 2 levels of ethanol, and placebo on surgical resident's cognitive and psychomotor skills were measured. Approval of the local medical ethics committee of Leiden University Medical Center was obtained to conduct this study in compliance with Dutch clinical trial law (WMO).

Subjects

Subjects were surgical residents who had completed an advanced laparoscopy course (ASC or OCEH, both are recommended for the Dutch specialist resident's curriculum for surgery, urology, and gynecology) or alternatively, had performed at least 75 laparoscopic procedures as main operator to guarantee an adequate level of laparoscopic proficiency. Subjects were different from the subjects in the exploratory study.

Study Treatments

Three succeeding intravenous levels of blood alcohol were reached in randomized order throughout one study day

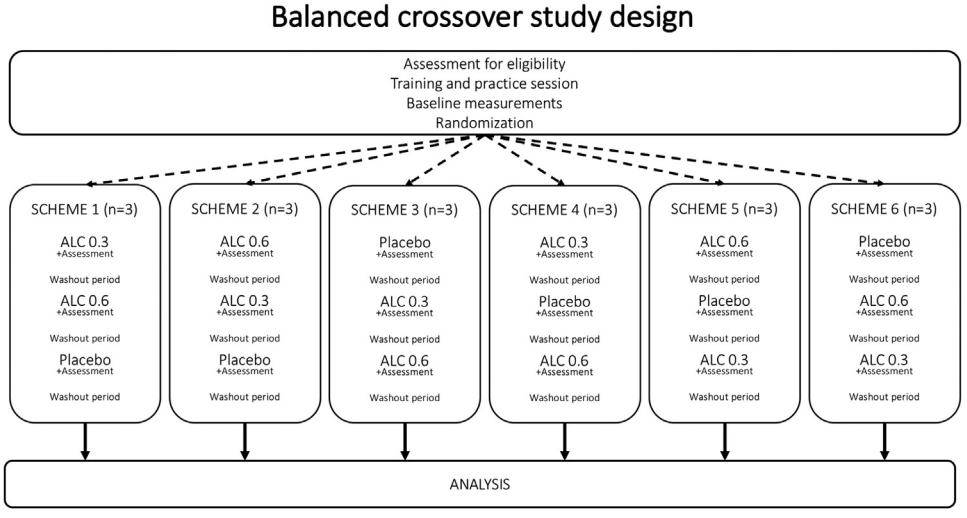

FIGURE 1. Balanced three-way crossover study design. A placebo-controlled randomized 3-way crossover study, succeeding intravenous doses were administered in randomized order, with wash-out intermissions, throughout 1 study day.