

Clarifying Assumptions about Intraoperative Stress during Surgical Performance: More Than a Stab in the Dark: Reply

Mark Wilson · Neha Malhotra · Jamie Poolton · Rich Masters

Published online: 3 December 2011

© The Author(s) 2011. This article is published with open access at Springerlink.com

We thank Dr. Ali for his concise annotation of our efforts to validate a tool that evaluates mental workload in surgery [1, 2]. Unlike other safety critical domains, the field of surgery has been slow to acknowledge the impact of intraoperative stress on surgical performance, but recently a sea change has been triggered by authorities in the field of surgical education [3]. We agree with Ali that stress is not by default detrimental to performance. Our aim was to develop a diagnostic tool that identifies the factors that contribute to disrupted performance, should it occur. Indeed, studies of the effects of acute stress on operating performance have shown considerable variability, ranging from no effect to either facilitative or debilitating effects [3–5]. The Yerkes-Dodson law emerged from the earliest attempts to explain the relationship between physiological arousal and performance, but it has been criticized for treating stress as a unitary construct, influenced solely by physiological factors [6]. More recently, Catastrophe Theory has been invoked to model the relationship, using both physiological and psychological (cognitive anxiety) components of stress [7]. The model proposes that physiological arousal displays a mild inverted-U relationship with performance when cognitive anxiety is low, but that catastrophic declines in performance can occur if both physiological arousal and cognitive anxiety are high. Recent surgical literature has elucidated the complexity of

stress as a construct and signaled the need for a multidimensional approach to the examination of stress in surgery [3].

The importance of investigating both subjective evaluations of stress and objective measures of performance under intraoperative conditions is evident when the workload measures from our study [2] are compared with the performance and stress measures that we used in a previous study [5]. In the previous study, we investigated laparoscopic peg transfer performance under time pressure, multitasking, and evaluation apprehension conditions using a multidimensional approach. That is, we included objective measures of motor performance (Imperial College Surgical Assessment Device; ICSAD) and both subjective (state anxiety) and objective (heart rate) measures of stress. Time pressure was perceived as most stressful, yet performance was maintained at baseline levels. In contrast, multitasking was not perceived as stressful, yet performance was disrupted [5]. Mental workload is an extremely useful construct when the intention is to examine the mechanisms underpinning such effects, as performance is governed by interacting demands of the task, circumstances in which the task is completed, and the skills, propensities, and perceptions of the individual performing that task [2]. Consequently, while multitasking was not perceived as stressful in our earlier study, it was rated subjectively as causing the highest task complexity, mental demands, and distraction on our SURG-TLX measure [2]. Based on these findings, it is not enough simply to reveal that a particular intraoperative condition caused a surgeon objectively to perform worse (as suggested by Ali); without clues to why performance was affected, prevention of potential catastrophes in the future is a “stab in the dark.”

Ali makes a valid point that individuals react differently to stress. For example, a surgeon who feels that he or she

M. Wilson (✉)

University of Exeter, Sport and Health Sciences, Exeter, UK
e-mail: mark.wilson@ex.ac.uk

N. Malhotra · J. Poolton · R. Masters

Institute of Human Performance, University of Hong Kong,
Hong Kong, China

has sufficient resources to meet the demands of a situation may view stress in a positive, “challenge” state, but a surgeon who feels dispossessed of the resources required to meet the demands of the situation may view stress in a negative, “threat” state [8]. We have previously shown that individual differences in trait anxiety [9] or the propensity for reinvestment [10, 11] have a significant influence on how efficiently an individual performs a motor task when under evaluative pressure, and recently we have begun to examine these questions in the surgical performance context.

Open Access This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

References

1. Ali AM (2011) The role of stress in optimizing surgical performance. *World J Surg* (Epub before print). doi:[10.1007/s00268-011-1316-z](https://doi.org/10.1007/s00268-011-1316-z)
2. Wilson MR, Poolton JM, Malhotra N et al (2011) Development and validation of a surgical workload measure: the surgery task load index (SURG-TLX). *World J Surg* 35:1961–1969. doi:[10.1007/s00268-011-1141-4](https://doi.org/10.1007/s00268-011-1141-4)
3. Arora S, Sevdalis N, Nestel D et al (2010) The impact of stress on surgical performance: a systematic review of the literature. *Surgery* 147:318–330
4. Andreatta PB, Hillard M, Krain LP (2010) The impact of stress factors in simulation-based laparoscopic training. *Surgery* 147:631–639
5. Poolton JM, Wilson MR, Malhotra N et al (2011) A comparison of evaluation, time pressure, and multitasking as stressors of psychomotor operative performance. *Surgery* 149:776–782
6. Yerkes RM, Dodson JD (1908) The relation of strength of stimulus to rapidity of habit-formation. *J Comp Neurol Psychol* 18:459–482
7. Hardy L, Parfitt G (1991) A catastrophe model of anxiety and performance. *Br J Psychol* 82:163–178
8. McGrath JS, Moore L, Wilson et al (2011) Challenge and threat states in surgery: implications for surgical performance and training. *BJU-I* 108:795–796
9. Wilson M, Smith NC, Holmes PS (2007) The role of effort in moderating the anxiety–performance relationship: testing the conflicting predictions of processing efficiency theory and the conscious processing hypothesis. *Br J Psychol* 98:411–428
10. Masters RSW, Polman RCJ, Hammond NV (1993) Reinvestment: a dimension of personality implicated in skill breakdown under pressure. *Personal Individ Differ* 14:655–666
11. Masters RSW, Maxwell J (2008) The theory of reinvestment. *Int Rev Sport Exerc Psychol* 1:160–183