



Automated, objective and predictive evaluation of technical skills in robot-assisted surgery

Andrea Moglia¹

Received: 21 March 2018 / Accepted: 3 June 2018 / Published online: 5 June 2018
© Springer-Verlag London Ltd., part of Springer Nature 2018

To the Editor:

I read with great interest the recently published article by Fard et al. entitled “Automated robot-assisted surgical skill evaluation: Predictive analytics approach.” [1].

Trainees in robot-assisted surgery (RAS) need to acquire different technical skills over traditional surgery because of the peculiarities of the da Vinci surgical system by Intuitive Surgical (Sunnyvale, CA, United States). In particular, the master console requires a proper level of technical skills (hand–eye–foot coordination) to become familiar with control interfaces, 3D vision, camera, and clutching. Therefore, objective and reliable assessment tools of technical skills are critical. In the article, Fard et al. describe a method of evaluation of the trajectory of surgical tools, present the results of surgeons executing knot tying and suture tasks with da Vinci robot, and report accuracy. The proposed method analyzes data captured from da Vinci robot using eight metrics for a deep analysis of surgical instruments: task completion time, path length, depth perception, speed, motion smoothness, curvature, turning angle, and tortuosity. Of these, the first two are indices of efficiency, while depth is assessed also by Global Evaluative Assessment of Robotic Skills (GEARS) [2, 3]. The proposed method is very useful since it computes automatically and assesses objectively performances, contrary to GEARS which is based on subjective evaluation. It uses more metrics for movement analysis than commercially available virtual simulators for RAS. Although these provide objective and automatic assessment, their analysis of trajectory is limited to time of completion and economy of motion (path length). In my experience as surgical educator using virtual simulators for RAS, most of times these two metrics are those distinguishing clearly novices from

experts, in accordance with published evidence reporting construct validity [4]. Although results of the study report a high accuracy on the two tasks (82.3% for knot tying and 89.9% on suture) there are some remarks. First, the study is limited to eight surgeons. More participants and exercises would be certainly useful to validate results, as discussed by authors [1]. Second, authors did not explain why a threshold of 15 and 19 at a global rating scale was used, respectively, for knot tying and suture task, to divide surgeons between novices and experts. Also the type of rating scale used is not mentioned. Although at the end of discussion, authors state that classifying surgeons based on their skills takes only few seconds with their method, they need a da Vinci surgical system, whose availability is restricted when it is not in clinical use [1]. Additionally, there are other metrics beyond those related to trajectory, not considered by this approach, but essential for a safe use of the robot, e.g. instruments out of view, which can be objectively measured by virtual simulators.

In conclusion, the method by Fard is very useful. I would suggest to also add bimanual dexterity, which is part of GEARS.

Acknowledgements This study was supported by Fondazione Arpa (<http://www.fondazionearpa.it/>).

Compliance with ethical standards

Conflict of interest Dr. Moglia declares he has no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. Fard MJ, Ameri S, Darin Ellis R, Chinnam RB, Pandya AK, Klein MD (2018) Automated robot-assisted surgical skill evaluation: predictive analytics approach. *Int J Med Robot*. <https://doi.org/10.1002/rcs.1850>. (Epub 2017 Jun 29)

✉ Andrea Moglia
andrea.moglia@endocas.org

¹ EndoCAS, Center for Computer Assisted Surgery, University of Pisa, Edificio 102, via Paradisa 2, 56124 Pisa, Italy

2. Maan ZN, Maan IN, Darzi AW, Aggarwal R (2012) Systematic review of predictors of surgical performance. *Br J Surg* 99:1610–1621
3. Goh AC, Goldfarb DW, Sander JC, Miles BJ, Dunkin BJ (2012) Global evaluative assessment of robotic skills: validation of a clinical assessment tool to measure robotic surgical skills. *J Urol* 187(1):247–252
4. Moglia A, Ferrari V, Morelli L, Ferrari M, Mosca F, Cuschieri A (2016) A systematic review of virtual reality simulators for robot-assisted surgery. *Eur Urol* 69:1065–1080