

A SURVEY ON PROCEDURAL VIRTUAL REALITY TRAINING IN LAPAROSCOPY

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BACKGROUND: Performing minimally invasive surgery requires complex skills. Tools to train such skills have been developed such as virtual reality (VR) simulators. Training on simulated procedures has the potential to bridge the gap between basic skills training outside the operating room (OR), and the execution of complex tasks in the OR. To obtain an overview of the status of procedural VR simulation for laparoscopic surgery available on the market we conducted an on-line survey and a literature search. **METHODS:** A questionnaire consisting of dichotomous, closed format and open format questions was developed together with expert surgeons and was sent out as an online survey (Conformit, Oslo, Norway) to companies and research groups selling and/or developing VR simulation systems for laparoscopic surgery. The companies and research groups were found through a search on the internet and in scientific publications. A search in the literature was done to find validation level of the procedural VR simulation identified in the survey. **RESULTS:** The questionnaire was sent out to eight companies/research groups. Six companies responded, of which five were included in the study: CAE Healthcare Inc. (Montreal, Canada), Mentice AB (Gothenburg, Sweden), Symbionix LTD (Cleveland, USA), SimSurgery AS (Oslo, Norway), and Surgical Science AB (Gothenburg, Sweden). All together these companies stated to offer 33 simulated procedural exercises, involving 19 different procedures (8 gastrointestinal, 10 gynaecological, 1 urological). Of the 33 exercises, 8 have been part of validation studies of which the results were retrieved in the review of scientific publications. The simulators all display performance metrics, which could be used for goal-oriented training and assessment purposes. In addition, three of the simulator companies say they can adapt it to a web-interface. **CONCLUSIONS:** Procedural VR simulation is a useful educational tool to minimize patient risk and to address the training of multiple aspects of surgical skills, beyond basic psychomotor drills. A large number of simulated procedures are available today and it is expected that the number will increase in the future. Continuing validation of the

simulated procedures is needed to increase the evidence of the benefits of procedural training on VR simulators.