



We need a paradigm shift in surgical training

Jacob Rosenberg

Department of Surgery, Herlev Hospital, University of Copenhagen, DK-2730 Herlev, Denmark

Correspondence to: Professor Jacob Rosenberg, MD, DSc, FACS. Department of Surgery, Herlev Hospital, University of Copenhagen, Herlev Ringvej 75, DK-2730 Herlev, Denmark. Email: jacob.rosenberg@regionh.dk.

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A recent article by Beyer-Berjot *et al.* has tested a virtual reality training curriculum for laparoscopic colorectal surgery (1). Although the study is interesting and well performed it is one of many scientific communications in this area of virtual reality training in surgery. The essential question may not be how to design a virtual reality based training curriculum but rather to discuss the place of virtual reality in modern surgical education.

So what is the real problem with surgical education today? Twenty years ago the surgical case load per surgical resident was undoubtedly higher than today where we tend to educate many new surgeons, and combining that with a restricted work-week (48 hours in Europe and 80 hours in the US) may make the task of surgical technical education challenging (2). Furthermore, there is an important issue of specialization that has to be discussed thoroughly. In most surgical educational systems around the world we educate our trainees to be broadly knowledgeable in many surgical subspecialties and to master a large variety of surgical procedures at a low level of expertise. Now try to look at this from the patient's point of view. Would the patient really need that a colorectal surgeon also knows how to do a thyroid resection? Or why learn to do a mastectomy and lymph node dissection for breast cancer if you want to become a master in hernia surgery? There is a pressure on surgical education demanding the education time to be as short as possible and this combined with the restricted work hours and thereby the surgical case load per surgeon in training requires a totally new look at the way we educate surgeons today.

There is no doubt that you will become a better surgeon if you practice (3). Thus, you will need a certain amount of

cases to master the basics and then depending on your skills and talent you may become a true master with even more training. Then the key question is if some of this training can be replaced by virtual reality training or other methods. Sadly, there seems to be very few data available showing a benefit in terms of reduced surgical complications in real patients with virtual reality training (4). A randomized, controlled trial showed decreased intra- and postoperative complications after laparoscopic inguinal hernia repair if the surgeons trained on a simulator until expert performance was achieved compared with standard practice (5). However, a recent randomized trial in laparoscopic gynecological surgery showed that preoperative warm-up exercise on virtual reality simulators did not influence operating time or complication rates (6). Of the more than 1,000 papers published on virtual reality in surgery most are unfortunately technical reports focusing on learning curves and similar virtual reality or machine specific issues not linked to real clinical outcome in surgical patients. Thus, the true effect of virtual reality in all surgical areas has not been clarified scientifically and today we can simply not answer the question if virtual reality is cost-effective in modern surgical education.

However, we may take a pragmatic and more practical approach to the use of virtual reality in surgical education. Numerous studies have shown the improvement in surgical technical scores when novice surgeons are training on low fidelity simulators such as a simple black box (4). There is of course an initial learning curve of basic instrument handling for laparoscopic surgery just as you would teach a young surgeon to tie knots in the office environment before he or she ties knots in a real patient. It therefore seems reasonable

and a good idea to implement low fidelity simulators such as simple black box models in the early surgical education to train basic instrument handling etc. Furthermore, these models are cheap and transportable so that they can be used at home and thereby outside the 48 or 80 hours restricted work week. At present it does not seem to be clear whether we should use virtual reality training for advanced surgical procedures. There seems to be no data showing that virtual reality training for the advanced procedures is transferable to the OR environment and more importantly will result in fewer clinical complications and a shorter OR-time. This advanced VR-equipment is quite expensive and we therefore have to be critical before broad implementation. In principle, it may be OK if VR replaces deficits in current surgical training, given that the training effect will be the same. This is, however, not supported by scientific evidence yet.

Modern surgical training definitely also has to comprise other important skills such as non-technical skills in the operating room (7) as well as professionalism training (8). Simple video-analysis may also be used to improve intraoperative performance (9) and video-telementoring may be a solution especially in areas with lack of experts available for hands-on surgical mentoring (10). Finally, the wind seems to be blowing away from a time-based training curriculum towards a more competency-based system (2) with implementation of a formal national certification of technical skills (11,12).

In order for surgical training to become really effective it may be necessary to look at hospital care from a higher political level. More than 10 years ago we calculated the maximum number of surgical trainees that could be trained in our country and in order for this to succeed it would be necessary to close many smaller hospitals and surgical facilities and centralize care to larger units with a patient accrual area of about 500,000–550,000 individuals for each hospital. This would enable a sufficient case load per surgeon in training and it would secure that the amount of time spent within the 48 or 80 h limit will less likely be wasted on non-educational activities including sleep (13). Even though a drastic solution with closure of surgical units from a viewpoint of surgical education will be difficult to implement the situation in our country has, mostly driven by lack of resources in general, resulted in closure of many smaller hospitals and now the number of surgical units has been reduced by more than 50% so we are slowly getting there.

In conclusion, virtual reality training for surgical

education may be a good idea when using low fidelity systems that can be used at home and are inexpensive to acquire. This will enable the surgeon to train basic laparoscopic skills such as instrument handling, knot tying etc. It is probably too early to decide whether the more advanced systems for complex surgical procedures should be acquired but if funding is already available and if it can replace some of the live OR-training, then it may be a good idea although solid scientific support is lacking. Meanwhile, we should not forget that surgeons also require training of other skills than the pure technical operative skills in the OR and the imposed restricted work-week now implemented in many parts of the World has made surgical training even more challenging. The first thing to do locally would probably be to look critically at the different work tasks that our young surgeons are faced with so that the educational quality of their time spend in the surgical department will be higher.

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