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My Thoughts/My Surgical Practice

Aptitude tests: Do they have a role in the training of the modern surgeon?

Our generation poses new challenges for the modern surgeon, which must be addressed in order to offer the best possible outcome for patients. With rising demand for surgical procedures, increased costs and a greater emphasis on safety, there is a necessity for surgical training to be improved by any means possible. In addition, modern legislation in the form of the European Working Time Directive has led to a reduction in the number of hours spent during surgical training making efficient learning a requirement. With this necessity arises a potential solution - surgical aptitude tests. Such aptitude tests exist in several forms; ratings of trainees' surgical performance by senior surgeons, simulations, and various other assessments such as the 'Gibson Spiral Maze Test', or the 'Space Relations Test', which evaluate specific skills deemed as being important in the surgical field. Based on recent studies, these tests may have the potential to predict the performance of prospective surgical trainees, improve surgical ability during training or even be used in the recruitment of trainees.

In training the modern surgeon, it must first be established what skills are necessary to excel in this profession so that such skills can be developed and improved upon. Thus, a possible benefit of aptitude tests is that they have the capacity to establish which skills are important for surgeons and then assess those skills. A study carried out in 2001 used hand-eye co-ordination, manual dexterity and visuo-spatial ability as parameters in order to compare the skills of medical students against those of seasoned surgeons.[1] The study concluded that the hand-eye co-ordination ability and manual dexterity of the practising surgeons was superior to that of the medical students, whilst the visuo-spatial ability of the surgeons was lower. The surgeons tested were regarded as 'master surgeons', suggesting that visuo-spatial abilities are not necessary in the training of a skilled surgeon, whilst manual dexterity and the level of hand-eye co-ordination differentiates experienced surgeons from those who have no practical experience.

This said, a study carried out by the department of psychology at the University of Edinburgh implies that there is a possible relationship between spatial ability and ratings of surgical ability. When a group of trainee surgeons were rated by consultant surgeons for clinical decision making and operating ability and then assessed for their spatial competency, those trainees who scored highly in the spatial ability tests also had better results in the surgical ability tests.[2] This implies that there may be a correlation between good surgical ability and spatial acuity. However, these results are dependent on the objectivity of the consultant surgeons in determining the surgical ability of the trainees. Similarly, Sankaranarayanan et al.[3] found that training under cognitive load benefitted performance in a virtual reality surgical task, indicating that cognitive skills are an important factor in surgical ability. In general, the skills pinpointed as being important in the training of the modern surgeon and which are assessed by aptitude tests, are those necessary for carrying out minimally invasive surgeries such as laparoscopic procedures.

By testing skills that contribute to the training of a successful surgeon, aptitude tests may have a role in the selection of candidates for surgical training. This is especially important as traditional methods of selection are subjective and do not appear to correlate with skill needed for surgery. In a recent study, it has been suggested that surgical dexterity levels do not correlate with the self-assessed skill levels of applicants to a surgery residency programme,[4] meaning that those who have the necessary experience and grades for pursuing a career in surgery may not have the manual dexterity levels required to carry out laparoscopic procedures. Harrington et al.[5] also found that visuospatial aptitude scores amongst medical students with no prior laparoscopic exposure and minimal videogaming experience, correlated significantly with multiple laparoscopic task metrics. These results imply that incorporating technical proficiency skills into the selection criteria for surgical training, may more effectively discriminate those applicants with an aptitude for a surgical specialty.

However, it can be argued that such skills can be learned throughout the training process, and to dismiss those who have a great interest in pursuing a career in surgery at such an early stage would rid them of the opportunity to develop the necessary skills and potentially become an equally proficient surgeon. In fact, it has been proven that participating in a micro-surgical training course results in a significant improvement in visuo-spatial, perceptual and psychomotor aptitudes.[6] This indicates that future learning potential must also be considered before trainees are decided upon.

Yet, it has been shown that psychomotor aptitude testing may have a role in predicting the rate of skill acquisition for laparoscopic training.[7] In this sense, aptitude tests that incorporate psychomotor skills evaluation, can predict training duration and thus tailor surgical training to individual needs by optimising curricular design. Individuals whose rate of skills acquisition is lower could be identified and then given further training and aptitude refinement. The use of such tests in conjunction with proficiency skills assessment as part of the selection process for recruiting surgical trainees, may prevent the dismissal of learning potential in those candidates who choose a career in the surgical field, but who perform poorly in preliminary skills testing. However, whilst some surgical ability can

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be developed through training, time constraints favour those candidates who acquire such skills at a faster rate. In like manner, aptitude tests may be used to help medical graduates to decide whether they would like to pursue surgery or medicine in their career. By giving some indication of future ability and suitability to train in surgery, aptitude test results may also lower dropout rates of surgical trainees and allow the appropriate allocation of limited resources.

The regular assessment of candidates undergoing surgical training provides feedback which can be used to improve performance so that procedures may be carried out in a safer manner in a real-life setting. Feedback based on intraoperative surgical performance has proven to be effective in improving instrument path time and instrument smoothness in simulated laparoscopic colectomy.[8] Thus, there is potential for feedback from aptitude testing during surgical training to be effective in ameliorating the performance of trainees, resulting in an earlier plateau in performance. Although self-assessment in this manner can improve technical skills, it is not sufficient to evaluate cognitive abilities which also need to be developed during surgical training. For instance, surgical observation is an integral part of training, however junior residents report cognitive challenges involving selective attention and information processing.[9] As discussed earlier, aptitude tests have the potential to assess the cognitive psychomotor skills that are associated with a high level of surgical ability. Therefore, feedback from aptitude tests could be used in conjunction with self-assessment to optimise performance during surgical training, hone cognitive skills and increase the level of improvement throughout the learning process.

Although aptitude tests test certain skills that may be necessary in surgery, such as manual dexterity and visuo-spatial acuity, there are other characteristics they cannot evaluate – for instance organisation and communication skills. Moreover, there is ambiguity surrounding which skills are more important than others and thus which need to be tested in aptitude exams. Those that have a high level of aptitude in one particular skill may exhibit deficits in other skills so it is difficult to ascertain their overall level of surgical aptitude. A possible solution would be to utilise aptitude tests in the training of surgeons who will specialise in a field that requires a significant level of technical mastery, for example, bariatric surgery. Furthermore, many of the studies that have been carried out to date investigating the validity of using aptitude tests in surgical training, have relied upon subjective ratings of surgical ability as the independent variable. Such methods are difficult to standardise as different surgeons will inevitably have different opinions and standards with regards to surgical ability. Other modes of testing aptitude such as virtual reality tools and laparoscopic simulations are limited by their degree of realism. Whilst modern technology has replicated the surgical environment to a great degree of accuracy, the fact still remains that such tools can never fully embody the real-life experience. For instance, in a simulation, one is unburdened by the thought of being accountable for a human life.

In the words of Hippocrates, “the life so short, the craft so long to learn”. Although the “craft” of surgery requires time, with the recent amendments in surgical training time, it is crucial that trainees learn as efficiently as possible with the ultimate goal of offering the safest possible care to patients. Aptitude tests have the potential to contribute to the achievement of this goal, but only if further research is carried out to address the challenges and restrictions involved.

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