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Surgical training fit for the future: the need for a change

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ABSTRACT

Postgraduate training in surgical specialties is one of the longest training programmes in the medical field. Most of the surgical training programmes require 5–6 years of postgraduate training to become qualified. This is usually followed by 1–2 years of fellowship training in a subspecialised interest. This has been the case for the last 20–30 years with no significant change. The surgical practice is transforming quickly due to the advances in medical technology. This transformation is not matched in the postgraduate training, there is minimal exposure to the new technological advances in early years of postgraduate training. The current postgraduate training in surgical specialties is not fit for the future. Early exposure to robotic and artificial intelligence technologies is required. To achieve this, a significant transformation of surgical training is necessary, which requires a new vision and involves significant investment. We discuss the need for this transformation in the postgraduate surgical specialties training and analyse the threats and opportunities in relation to this transformation.

INTRODUCTION

The landscape of surgical practice is changing with pace. The acceleration of technological advancement and its application in the medical and surgical fields is astonishing. It was not that long ago when artificial intelligence (AI) and smart machines were depicted in Hollywood movies as science fiction; something from the future. Now, robots are established part of surgical teams in some surgical specialties, it is a matter of time till AI and robotics become at the core of medical and surgical practice.[1–3]

When joint arthroscopy was introduced, it was seen as an unnecessary tool, costly, time consuming and results were doubtful.[4] Now arthroscopic procedures are the gold standard for many surgical interventions.[5] Similar criticism is currently casted on the use of AI and robotics in healthcare. However, the evidence suggests that it is the future of healthcare.[1 6]

This rapid advancement in medical technology poses a real challenge; practising surgeons need to master these technologies to be able to practice let alone teaching their juniors. It is extremely difficult to balance work commitments and find enough time to learn new skills. The new technologies will act as a force multiplier, the landscape of healthcare will be significantly different than what we see. To match this massive change, medical training and education has to respond with urgent and scalable measures. Surgical trainees are already suffering from reduced training hours with less exposure to surgical procedures.[7 8] Along with high public expectations; patients expect surgical procedures to be done using the most advanced methods and by a fully qualified surgeon, not surgeon under training.[9]

Healthcare and surgical education leaders need to find a balance between workload and advanced skills training for both experts and trainees. In response to this need, multiple bodies produced reports, guidance and vision for the future of training in surgical fields.[10–12] These reports aim to address multiple issues related to advances in surgical technology and which technologies are likely to be widely used in surgical practice, how to regulate these technologies and to shape the surgical team and the training of future surgeons.

It is anticipated that the need for surgeons will remain with high demand, the fear that robots and machine will take over the role of the surgeon is unfounded.[13 14] However, the surgical practice is likely to change, surgeon is expected to work in multidisciplinary team.[15] Surgeons are expected to be proficient in the new technologies as well as have multifaceted skills.[16–18]

It is also expected that there will be increased requirement for surgical training; trainee surgeons will be expected to spend considerable time of their training in the laboratories and workshops learning new skills and mastering them to be approved as trained surgeon. Virtual reality (VR) and augmented reality (AR) are anticipated to be part of daily surgical practice. Simulation training to include VR/AR technologies will be the mainstay of surgical training.[19–21]

NEW TECHNOLOGIES

AI is a loose term used to refer to any advances that is dependent on new technology. AI is expected to be integral part of hospital management, patient medical records, pharmacy system and day to day patient care. AI applications in surgical field can be categorised into machine learning, robotics, computer vision including virtual and AR and neural networks.[22 23] Machine learning where computers use complex algorithms to learn human patterns and recognise behaviours, which in turn will result in changes in the machine response. Machine learning applications in surgical field can help modify treatment plans and predict prognosis. Robotics and automated machines have already gain presence in surgical fields, it is predicted that robotics will outperform the average human skills and be integral part of surgical teams.[24] Computer vision is another significant aspect of AI application in surgical field, such machines already achieved human level analysis of diagnostic imaging.[25] The use of AR and VR applications in surgical practice is huge. Wearables that can superimpose high resolution CT and MRI scans on the actual surgical field

to guide the surgeons into correct orientation and to help accurate implantation of devices will be the mainstay of surgery.[26–28] Neural networks where computers process data and images in a similar way the human neurons work and interact to predict relations and patterns which aims to help diagnosis and identification of abnormalities.

It is important to recognise that these different technologies are synergistic and used collectively hence the need to be familiar with them, surgeons are expected to have basic understanding of the concepts behind these technologies.

WHAT DO WE KNOW SO FAR?

It is important to recognise the unique opportunity to re-structure and shape of the future surgical career pathway. Emphasis should be on integration of multidisciplinary teams and new technology in training and career development. It is also vital to acknowledge the current structure of training which leads to acquisition of the baseline knowledge and skills appropriate to the level of a consultant surgeon. These baseline knowledge and skills are usually certified, such as the American board exams, Canadian Royal College specialisation certificates and the British Certificate of Completion of Training. Such certifications should continue to be the backbone of future surgical training. However, postqualification and mid-career training should be regulated and be part of continuous career assessment to demonstrate proficiency in the use of new technologies and techniques.[29 30]

There is a call to start surgical training early and to avoid repetition, and instead, to build on previous acquired knowledge. Human factor is expected to be integrated in surgical training as a key component of patient safety. The traditional surgical training is too rigid with limited possibilities for trainees to diverge. There is always constant pressure on trainees to adhere to the chosen pathway with no flexibility and less options to try different routes.[7 31 32]

Surgeons in training and established surgeons need more exposure to new and emerging technology throughout the surgical career. There is a growing need for more support for surgical training. Training bodies and educational organisations are required to set aside recourses to implement changes in the current curriculum to meet the needs for the future surgeons.

Published reports identified multiple new technological methods to have high impact on the surgical practice in the future. This can guide surgical trainees to focus their training on these areas and to plan their training to fit a subspecialised route in-line with these technologies.

CHALLENGES

The financial implications on surgical training are significant, both from trainee's perspective as well as training bodies and authorities. Training surgeons to adapt new technologies comes at a huge cost. The current state of the National Health Service (NHS) with the financial burden and cost cutting efficiency measures makes it almost impossible to introduce this technology training in the near future. There are calls for the medical devices industry to bear the cost of surgical training. Indeed, the industry has been providing similar training for trainees and consultant surgeons, however, this is voluntary contribution not guaranteed to last especially that the global economy is struggling to maintain the current level of growth. Also, the quality and the level of training provided by these companies are not regulated with wide variation in content, depth and quality.

Mid-career surgeons are at the appropriate level of experience to undertake advanced technological surgical procedure. However, there is lack of clarity about the pre-requisites to pursue this step. As we already know, surgical skills and expertise vary widely among surgeons,[19] which makes it difficult to standardise the training without established prerequisites for this training.

Another significant concern is the need to create a regulatory body for these new technology and training. It is anticipated that these technological advances are likely to crossover between medical and surgical fields with multidisciplinary teams to be the core of medical and surgical treatments, there might be a need for new independent body to oversee these technologies and regulate its use and the training associated with it to provide the public accountability.

OPPORTUNITIES

Despite multiple challenges, there is a significant opportunity to create a momentum and lobby the stake holders and government bodies to modernise the surgical training and embrace the new technological advances. UK has always been in forefront of medical advances, indeed UK institutes such as Oxford and Cambridge Universities are exemplar of integration of modern technology with current practice. However, this momentum requires much more force and involvement to create sufficient change.

The Royal College of surgeons of England (RCS-Eng) report[10] provides a road map for medical students and surgical trainees to seek training in the highlighted areas related to modern technology and pioneer the career change and progression. It creates opportunities for the industry to target future requirement of surgical tools and technology as well as take part in providing training opportunity for the future surgeons.

THREATS

There are multiple threats around the future of surgical training. The current political atmosphere might not be encouraging to implement such changes. In principle, modernising surgical training should be welcomed by any government regardless of its political orientation. However, for a government to adopt this, it has to set aside significant financial and administrative resources. This does not look favourable in the current situation with the ongoing financial strain on the NHS as well as the uncertainty of BREXIT with its resultant potential loss of foreign talent, which creates unhealthy environment for the medical device industry to target the UK as a platform for new advances and early implementation of such technology.

Surgeons in the UK are trained to follow evidence-based practice. Adopting new technology might be slow, as most of the surgeons would like to see enough evidence to support the use of new technological advances before including it in their practice. This might take years to become evident, which might mean that UK healthcare will be lagging behind other countries that adopt these technologies earlier.

ETHICAL CONSIDERATIONS

Multiple ethical and moral concerns will need to be taken into consideration. Consenting the patient for the use of AI machines might be challenging, these technologies are complex to the point that is difficult to explain in simple terms, however, it is expected from surgeons to explain the procedure with enough details to obtain informed consent. It is very likely that a specialist in the field of medical AI technology will have a role in healthcare management and might be part of multidisciplinary team looking after surgical patients, a defined pathway

is needed to clarify liabilities and interactions between members of the surgical team. This will also require changes in the laws concerning medicolegal disputes.[33]

There have been multiple security breaches of the healthcare systems in different countries recently which resulted in significant financial loses and leak of sensitive patient data which exposed the fragility and vulnerability of the healthcare IT systems.[34] With introduction of these new technologies the risk is much higher, this requires intervention and a national and international levels.[35] Surgeons should be trained to recognise patterns of malfunctioning AI machines and should have freedom to report any safety and security concern.

AI technologies are designed to help surgeon decision making and influence thought process based on analysis of available data, this by itself is favourable and should be encouraged. However, it might result in rigidity of thinking and may result in a system where surgeon will face legal implications if his decision deviates from the recommended AI decision. On a long term, this might impede surgical training as the thought process to reach a surgical decision will be dependant of the AI machine with minimal clinical reasoning, trainees will have less chances to question the decisions and understand the reasoning behind it.

We live in multiculture societies, surgeons and healthcare leaders have duty to ensure variability of human anatomy or racial differences are addressed within the training programmes to avoid patient safety concerns when applying these technologies on ethnic minorities.

CHANGE STRATEGY

In his recent speech, Matt Hancock, the secretary of State for Health and Social Care[36] emphasised that better technology is vital to have for the NHS. He identified few aspects needed to focus on to be able to transform the NHS into a technology hub. The structures in the NHS were one of the main aspects, to be able to accommodate modern technology the whole NHS structure needs to change. Current levels of bureaucracy will make it difficult to adopt new technologies, the way the NHS is managed will have to be more flexible and forward thinking.

There have been multiple steps to adopt new technology, the NHS digital is one of the governmental bodies responsible for application of digital technology in the NHS.[37] Unfortunately, this has seen multiple failures recently including claims of wasting huge sums of money on failed projects such as digital transformations of patient records.[38] These failures among other reasons for low morale of surgical trainees (for example the recent junior doctors' contract dispute) make it difficult and unplausible for junior doctors to consider taking a career path that involves new technologies. As the career vision is not clear, there are doubts on financial support for the NHS to adopt the new technology, there is no clear guidance on how trainees can get sufficient training to master these new technologies.

In my opinion, the change has to start at medical school. Social and media campaigns to attract talents and innovators into medical fields along side early exposure of medical student to new technology. Medical students should be involved in the vision for the future, they need to understand how the healthcare system will look like to be prepared mentally and to give them the chance to adapt modern technology early in their career.

LEADERSHIP IMPLICATIONS

In his speech, Hancock praised the NHS Leadership Academy (NHSX) for its efforts to create healthy leadership atmosphere in the NHS. In the last couple of years, the NHSX has been providing multiple training courses and workshops for the NHS staff to create a group of highly motivated leaders to lead the NHS transformation. It is clear that the required changes in the NHS must come from grass root leaders not from top down.

Rogers described the grouping of people in response to change[39] to fall into five subdivisions, the innovators, early adopters, early majority, late majority and the laggards. NHS aims to recruit as many innovators and early adaptors to lead the transformation the NHS into the digital era. This vision requires the current NHS leaders, and I mean the grassroot leaders as well as the top leaders, to have an open-minded approach to new ideas and technologies. It is not possible to enter the digital era with the traditional leadership mentality. Current leaders will have to either step up their game or to make way for new leaders who have the vision to guide the NHS into digital and modern technology transformation.

These changes will not happen overnight, it is frustrating to know that a new research findings take an average of 17 years to be translated into practice.[40] This delay is no longer acceptable in the medical field, the current rate of acceleration in technology means that within 17 years the current technology is likely to be obsolete. The adaptation of new technology will have to be much faster; this has a huge implication on healthcare leadership. NHS leaders are expected to be able to identify the potential need for early adaptation while maintaining the standard of service provision and patient safety. This might be the most significant challenge facing the healthcare leadership as the time and resources will always be obstacles against any radical change in practice.

CONCLUSION

Current trainees in training grades belong to an era of technological advancement, it is not a surprise to find that these trainees are much more computer savvy and technologically oriented more than their trainers. This can cause a dilemma, trainer who has surgical experience but limited exposure to AI is expected to train a surgical trainee who has limited surgical experience but AI savvy. This can result in either exchange of knowledge and skills in ideal case situation or can lead to loss of confidence and communication block.

Healthcare leaders and experts must recognise that the shape and the future of healthcare system will not be the same in few years. The rate of technological advances is high, new technology and techniques will take much less time to be implemented in daily practice. Leaders will have to pave the way for the future trainees to adapt the changes, they have to adapt this vision and take necessary actions now to be able to catch up with the modern healthcare. The way the NHS is manged and lead at the moment needs radical change to be fit for the future. Current NHS structure is not fit for purpose, future of medical care will be multidisciplinary teams, community-based care with high level of patient expectations and demands.[41] This combined with highly sophisticated medical technology necessitates immediate and radical changes to surgical training and career pathways.

Multiple documents and reports set the starting point for the vision of the future; similar initiatives are required to keep the momentum of change and the shape the general public as well as the professional atmospheres. Perhaps healthcare leaders as well as educators could guide the transformation; small initiatives at a local level such as workshops on new technology, presentations from industrial partners could keep the momentum and stimulate surgical trainees to seek information and guidance on their future career.

List of learning points

⇒ Surgical practice will be different in the near future.
⇒ Artificial Intelligence and other technological advances will be in the core of surgical practice.
⇒ Current surgical training programmes are not fit for the future.
⇒ Significant investment is required to meet future surgical training needs.

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