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Perspective

Academic surgery amid the COVID-19 pandemic: A perspective of the present and future challenges



ABSTRACT

This narrative review describes the trials and tribulations of academic surgeons in four major cities of their respective countries and the solutions they retained to keep academia alive in their practice. The four pillars of an “academic surgeon” —teaching, producing scientific works presented in meetings, publications and research—are dealt with bearing in mind the modifications brought about by the pandemic and the solutions to keep academia active.

Throughout the pandemic, the ultimate goal has been and will be to improve care and train the next generation of surgeons and encourage and monitor researchers, guide the mentees through the tasks of leadership, and foster good sound presentations at scientific meetings and encourage innovative and fruitful publications. The pros and cons of the alternatives imposed by the pandemic for the above-mentioned academic components, based on the literature, are reviewed and analyzed as they are taking place today in Shanghai, Milan, Graz, TaiChung and Hsinchu.

Our perspective for the future is that teaching will take a new aspect and make wide use of electronic platforms, but also, the face-to-face modality will surface again. According to local needs and funding, many will most likely choose the hybrid solution (electronic and presential). Production of scientific works in meetings has gained momentum, again with the hybrid solution being preferred. Scientific publications have already increased on topics that are no longer related to COVID-19, and both clinical and experimental research are flourishing.

This review can provide insight to guide young and accomplished academic surgeons through these difficult times and beyond, promoting a renaissance of clinical research and relevant publications, teaching of surgery and scientific meetings with a hybrid approach, and, finally, contribute to the training and formation of a new generation of surgeons for the future post-COVID-19 era.

1. Introduction

At a time where the number of surgeons who pursue an academic career has decreased [1] and recently was heavily taxed by the ongoing COVID-19 pandemic [2], several surgeons have reflected on the consequences on academic surgery [3–5] and collaboratively, along with others, have laid down recommendations for dealing with academic activities during the pandemic and construction for the future [6].

While a wealth of publications has focused on the aerosol transmission of SARS-CoV-2 [3–7], how surgical units and hospitals have had to deal with the COVID-19 pandemic (decreased number of surgical beds attributed and shifting personnel to the care of the COVID-19 infected population), de-programming of elective surgery, decreased number of patients needing surgery because of the fear of patients to present to the hospital [8], little has been published on the consequences the COVID-19 pandemic has had on academic surgery and the academic surgeon [6,9].

In a quite banal sense of the term, an “academic surgeon” is believed to refer to any surgeon who is associated with and works as a faculty member within a medical school’s department of surgery [10]. Academic surgeons have been defined as “triple threat” surgeons: they operate, they teach, and they also do research [11]. In a survey conducted among seven prominent surgeons from Baylor University [12], academic surgeons were defined as those who were capable of identifying complex clinical problems, an expert in fields that others have

ignored or thought unsolvable, are clinically innovative, spread knowledge through publications, presentations and practice guidelines, search ways to further improve care and train the next generation of surgeons and researchers. Administrative skills have also been added as a part of the prerequisites for academic leadership [13].

COVID-19 has forced us to imagine alternative innovative processes for these academic components. Teaching, telehealth expansion, virtual Grand Rounds and society conferences, education, examining and taking board certification, scientific meetings, and Webinars *via* Zoom or other electronic platforms are just a few examples. Attesting to the popularity and widespread use of electronic platforms, a recent report estimated that the number of users has risen from 3 million in April 2020 to over 200 million today. Profits from ZOOM have risen from some 770 million USD in October 2020 to 1.02 billion USD in July 2021. Microsoft Teams saw an enormous rise in use, escalating from some 20 million users in November 2019 to over 75 million in April 2020. However, unanimity is far from reality with respect to the future continuation of web-based virtual meetings and communications. Even the founder of ZOOM has complained of ZOOM fatigue [14].

The literature has raised contradictory pros and cons with regard to the consequences and impact of the pandemic on teaching. Although COVID-19-related restrictions did not affect all countries around the world in the same manner, the effects on learning surgery were one of the top priorities for young surgeons in training [6]. According to the BJS collaborative survey of 359 hospitals in 71 countries around the

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world (late March 2020), about 14 million procedures (including gastrointestinal/pancreatobiliary, urological, head and neck, gynecological/obstetric, plastic, and orthopedic) had been cancelled or postponed [6]. The geographical distribution was uneven: China, United States, Russia, and United Kingdom were hit harder than countries such as Australia, Scandinavia and New Zealand [6]. Cancellation rates were 30% for approximately 0.1 million cancer and 84% for about 13 million non-cancer operations. Consequently, there were fewer opportunities for trainees to see and participate in surgeries [15]. Seeing operations in real life, being able to participate in operations (hands-on), taking part in intra-operative decision-making, and post-surgical care based on what was observed during the operation were absent from the trainees' daily life for various periods of time [9] and had serious consequences in training that are only beginning to be known [6,10,11]. A review of trainee logbooks in the United Kingdom comparing the years 2019 and 2020 showed a 50% reduction in operations with trainees as the primary operating surgeon [16].

Innovative teaching procedures were introduced [17–28]. While there was a nearly 40% increase in the number of online teaching program users in one nationwide study [17], and proponents have lauded the possibility of expanding impact across borders to reach more students and offer new learning opportunities from guest lecturers, reduced training costs, and access to subject matter experts (regardless of location) [18], the long-term consequences of such training programs remain unclear. Of note, the outreach of online teaching programs is basically observational and has not been codified. How they will affect the future population of trainees and trainers is shadowy and difficult to portray. While the feasibility of e-training has given rise to some favorable comments, other research papers [19] have reported negative effects. Some of these have been summarized in a web-based site of the University of Alberta [29] and include, among others: 1) not all participants are visible. Indeed, participants can only be seen if they switch their camera on. Some might feel shy or uncomfortable and remain with their camera off [30], and may influence others to do the same [31]; instructors cannot recognize the faces of the students in real life because they did not see them during the e-learning platform [29]; 2) the desire to maintain privacy with respect to home life [22,23,32]; 3) multi-tasking (reading one's SMS or emails, searching information on the Web at the same time), possibility of eating, smoking, and discussion without disturbing the event but that can impact the message received is more common when students are disengaged or uninterested in the course [30]; 4) "Zoom fatigue". Attending electronic distant meetings for extended periods of time, such as several hours of online classes per day, is cognitively and mentally draining [14,33].

Although a recent survey of residents [20] found that trainees preferred live, interactive, procedure-based, consultant-led sessions lasting approximately 30 min to 1 h and covering a myriad of surgical specialties, the need for remote and informatic formats has generated new and innovative ideas such as flipped classroom models [21,22], online interactive practice questions, teleconference lectures, and involvement of residents in telemedicine clinics [22,23]. Procedural simulation may be useful for junior learners but senior residents perceive this type of training as lost operative experience [24].

Finally, the use of surgical videos, commented and discussed in groups, or video feedback (similar to training in high level sports) has been introduced in several universities [22,25]. Video reviews and electronic remote journal clubs have been reported with variable success and efficacy [26]. One of the problems with implementing video-based education is the need to ensure that available material show standardized, evidence-based techniques, and contains clearly declined step-by-step instruction. One solution might be to use a commercially available head-mounted video recording devices [27] with modified lenses to produce high-definition first-person point-of-view intra-operative videos which are then livestreamed through a videoconferencing platform, thus providing remote learners with a real-time view of the surgical field and simultaneous audiovisual communication with the

operative team. However, there have been no further studies to validate this teaching method. One recent survey [34] found that many residents view publicly available material on the internet, which is often not peer-reviewed, potentially industry-driven and unregulated [35–37]. Access to Society webpages and education portals that offer peer-reviewed videos of higher quality may be limited due to cost or subscription requirements. Clearly guidelines for producing surgical educational videos are needed and must be used to uphold quality standards of the educational content [38,39]. Further studies are needed to structure their pedagogical utility and assess their efficacy/effectiveness in the teaching process. The importance of peer-reviewed videos as an educational tool cannot be underestimated; recommendations and guidelines for standardized, high quality pedagogic videos are available [36–39].

A recent systematic review analyzed the results of studies on how COVID-19 has influenced surgical training [28]: data came from more than 20 countries (including the United States) with 5260 trainees and 339 program directors. Teachers world-wide have been asked to shift their task assignments: reassignment to non-surgical roles of potential teachers during the pandemic varied across studies from 6% to 35.1% [28]. Operative experiences were found to be reduced over all the studies. 17 of 29 studies reported a switch to online platforms for learning. Only 7 of 29 reported that trainees had increased time to devote to educational/academic activities. Negative effects related to increased stress were noted in 54.9%–91.6% of trainees [28]. In another systematic review from Hong Kong, Co et al. [40] found that a) students' performance, learning motivation and performance (essentially task completion time) improved in 8 of 10 analyzed studies, b) 6 out of 10 student feedback studies highlighted the flexibility, efficiency, increased motivation and better viewing angles as positive points, while c) four studies underscored the lack of personal contact with tutors, poor network connections and reduced student concentration as negative points. Of the 7 studies evaluating tutors' feedback, ease of tracking silent students, monitoring performance and the possibility of updating fast-changing knowledge were among the constructive remarks while lack of hands-on experience for students, technical issues and high costs were the main adverse concerns [40].

Among unsolved issues in electronic teaching are the universal availability of the equipment (computer, high quality imaging screen, networks ...) necessary to participate at home for all students, the variability of internet connections from one region to another, from one moment of the day to another [30,31,40] and the problems due to internet traffic [24]. While the feasibility of distant teaching is obvious, and the potential efficacy probably not much different from traditional methods, many of the numerous surgical education programs that have spawned the web are unmonitored and/or commercially driven; their educative merits warrant evaluation. As expressed by Hope et al. [28], delivery of surgical training will need to move away from traditional models of learning to ensure trainees are competent and well supported. Finally, it remains unknown whether teaching institutions will continue along the same lines or revert back to pre-COVID-19 methods once the pandemic has resolved or perhaps, adopt a hybrid format. In reality, little is known about the long-term efficacy of e-learning platforms in instruction or learning other than information gleaned from some of the small studies (with the well-recognized drawbacks of surveys [41]) on the topic. A recent survey of medical students in Homberg, Germany sought to obtain the effects of the innovative e-learning platform in surgical skills. 54% responded that they were satisfied, but overall, the 59% voiced that a hybrid solution was best, combining the e-learning with face-to-face presential teaching sessions [42].

As international meetings are starting again, most organizers have had to abide to travel and group gathering restrictions as required by local governments and health authorities, and many adopted either the complete remote or the hybrid format using electronic solutions (Zoom or other similar electronic platforms) to include foreign speakers and enlarge the audience. Many of the negative effects of not attending a live

meeting are somewhat similar to those expressed for e-learning platforms. Surgeons seem to miss the face-to-face, social aspect of live meetings. Speakers now give talks where they can see themselves (rather than the audience) on the screen: does this affect the way they deliver? Sometimes, the talk is pre-recorded: usually no active exchange is planned. This depersonalizes the talks, and may take away from the strength of the message delivered. While the theoretical number of participants may be greater than face-to-face meetings, there is no way of knowing whether the participant is effectively listening or involved in other activities or even absent from behind the screen: effectively, participants look at their screens to see the talks given in meetings and congresses at home with surrounding distractions (family life and responsibilities) and the possibility of multi-task activities, as mentioned above [29–31]. Time zone differences for speakers and listeners from far-away countries (e.g., one speaker in California for a meeting based in Shanghai, and then a second speaker from Sao Paulo) create scheduling problems for which solutions are not the same around the globe. Obviously, the speakers and participants no longer have travel and accommodation expenses to burden, and the organizers of meetings might well continue these teaching platforms once the pandemic subsides, if only for economic reasons. In the future, we will most likely see more and more hybrid solutions, where some speakers and participants travel and are on site while others remain at home and speak on the virtual platform. Another theoretical advantage of the hybrid formula is that it allows people who normally cannot travel or pay for registration, travel and or accommodations to access the meeting.

The consequences on research have also been targeted in several publications. The pandemic truncated many academic, industry, and government basic science and clinical research projects, or redirected research to COVID-19 related topics. Pluridisciplinary and international experimental works were discontinued because of University regulations due to COVID-19 as well as to travel and face-to-face restrictions [43,44]. Many laboratories and research units had to shut down because of lack of personnel [43]. Several clinical trials underway at the time of the outbreak, with perhaps the exception of those testing life-saving or cancer-related therapies, have been discontinued or slowed down, and many are now closed to new enrollment [17]. Decreasing patient accrual has been a major obstacle to ongoing clinical trials during the COVID-19 pandemic. Patient accrual now requires avoiding aerosol generating procedures [7], patient COVID-19 testing, drive-up scenarios, and not the least extra-funding to pay for these changes to keep the clinical research development ongoing. In addition to short- and long-term patient impact, disruptions in research have threatened the careers of physician-scientists, many of whom have had to shift efforts from research to patient care. The COVID-19 related restrictions led to a major problem when laboratory experiments required the physical presence of manipulators, technicians, animal care personnel or data analysis. This situation has led to hierarchical-based harassment and threats [26]. Research assistants now have a more complex working schedule. Of major concern are security issues when physical presence is needed (protective gear, testing, taking temperature on site ...), leading to potential falsification demeanors, missing data, and inconsistent patient adherence, just to name a few. Consequently, remote monitoring is becoming more common, and replacing some onsite visits [44]. However, at this stage, there are little data to demonstrate their feasibility or practicability. Time will tell if this technology is really needed, and if it works.

In certain countries and research governing schemes, funding has shifted from cancer research to provide funding for studies on COVID-19 related detection, testing, prevention (vaccines and drug) and treatment [43]. We fully endorse the plea that researchers in cancer counter the COVID-19 related recession and effectively revive cancer research immediately after the lockdown ends while starting new trials [43].

Bertuzzi and DiRita [45] outlined their thoughts on the need for a new research system. They highlighted the need to open up both to the public and to society. We, as scientists, have to become visible and speak

clearly, and not only talk in ivory towers. We need better science education and training as mentees, and to teach these same principles, as mentors. Research has to have real world goals, as much as theoretical (effectiveness not only efficacy), not wasting funds and energy, what these authors called “pointless” research [45]. We agree that future research should englobe gender diversity and open the frontiers to international cooperation that has suffered from travel restrictions due to the pandemic; we need to find ways to incentivize research projects across borders (of state and of mind). Our universities have to find ways to foster and recognize larger and international research teams and open in-roads to safe but effective access to and sharing data across international databases.

As publications have heavily concentrated on how to deal with the consequences of the COVID-19 pandemic [7,8], the emphasis on research has yet to be determined. According to Holly Else in Nature [46], around 4% of the world’s research output was devoted to the coronavirus in 2020. But 2020 also saw a sharp increase in articles on all subjects being submitted to scientific journals — perhaps because many researchers had to stay at home and focused on writing up papers rather than conducting research [46].

In a comprehensive meta-research on original articles, research letters and case reports published between January 01, 2019 and January 01, 2021 in 10 high-impact medical and infectious disease journals (New England Journal of Medicine, Lancet, Journal of the American Medical Association, Nature Medicine, British Medical Journal, Annals of Internal Medicine, Lancet Global Health, Lancet Public Health, Lancet Infectious Disease and Clinical Infectious Disease), the authors found a dramatic rise in COVID-19 publications accompanied by a substantial decrease (18%) of non-COVID-19 research [47]. Overall, 1022/6319 (16.2%) were related to COVID-19 research, that was responsible for lower percentage of original articles (47.9% vs. 71.3%) [47].

The pandemic also fueled a sharp rise in preprints (articles posted online before peer review) and affected review times — speeding them up for some topics but slowing them down for others [26]. Scientists published well over 0.1 million articles about the coronavirus pandemic in 2020. By one count, from the Dimensions database, they might even have passed 0.2 million by early December 2020 [46]. China was second only to the United States, accountable for almost half of COVID-19-related papers in the first quarter of 2020 [46]. The sharp rise in preprint repositories is indicative of the shift towards open-platform research triggered by the COVID-19 pandemic. This new platform may enhance data sharing with public health authorities, but the challenges created by lack of preprint accountability and transparency remain. For the moment, repository-hosted, COVID-19-triggered preprints and other non-peer reviewed research are of questionable scientific value and our task as academics is to make sure that the public, who now has open access to many of these publications, is aware of these limitations [48].

The rising popularity and the contribution to the scientific world of social media has been touted to be a solution. However, there is no peer review of what goes into the message. The impact on academic surgery from the current sky-rocketing social media is far from structured [22, 49] and needs to be defined [50].

While we recognize that our analysis suffers from shortcomings that originate from different geographical and political issues world-wide, the overall impact on academic surgery in the wake of the COVID-19 pandemic requires attention. An academic surgeon is recognized by the passion with which he or she works (whether in clinical care or research) or teaches. It befits the academic surgeon to be a mentee at the same time as a mentor. How COVID-19 has affected the passion and humility of academic surgeons remains to be seen. How the change of surgical priorities in the operating room (and the consequences on teaching and learning of surgery in that setting), how the lack of time from teaching and research due to the overload of emergency care (and the consequent shifting of rotations from surgery to intensive care and online teaching platforms), how negative effects on the mental health and wellbeing of trainees during the pandemic [6,28,51] and finally

how the future education in surgery will affect the current generation of future academic surgeons are currently in the limelight.

Most of these recommendations and adjustments are taking place today in Shanghai, PR of China, Milan, Italy, Graz, Austria, Taichung and Hsinchu, Taiwan. Our perspective is directed toward a renaissance of clinical research and relevant publications, teaching of surgery and scientific meetings adapted to local needs and resources, with a preference toward a hybrid approach. We hope for the training of a new generation of surgeons, who, despite the obstacles and challenges brought forth by the pandemic, are academic in spirit and practice, but, above all, capable of taking care of patients according to best practice recommendations and guidelines. We entrust our fellow academics around the world to set similar goals.

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MinHua Zheng: Conceptualization, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **Luigi Boni:** Methodology, Validation, Formal analysis, Investigation, Writing – review & editing. **Selman Uranues:** Methodology, Validation, Formal analysis, Investigation, Writing – review & editing. **William Chen:** Methodology, Validation, Formal analysis, Investigation, Writing – review & editing. **Abraham Fingerhut:** Conceptualization, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Supervision.

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MinHua Zheng

Department of General Surgery, Ruijin Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai Minimally Invasive Surgery Center 197, 2nd Ruijin Road, Shanghai, 200025, PR China

Luigi Boni

General and Emergency Surgery, IRCCS - Ca' Granda - Policlinico Hospital, Milan, Italy

Selman Uranues

Section for Surgical Research, Department of Surgery, Medical University of Graz, Auenbruggerplatz 29, 8036, Graz, Austria

William Tzu-Liang Chen

China Medical University Hsinchu Hospital, Hsinchu, Taiwan

Abraham Fingerhut*

Department of General Surgery, Ruijin Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai Minimally Invasive Surgery Center 197, 2nd Ruijin Road, Shanghai, 200025, PR China
Section for Surgical Research Department of Surgery Medical University of Graz, Auenbruggerplatz 29, 8036 Graz, Austria

* Corresponding author.

E-mail address: abefingerhut@aol.com (A. Fingerhut).