New settings in Anatomy and Surgery Teaching During the Covid-19 Pandemic

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To the Editor, *Anatomical Sciences Education*:

Teachers worldwide were surprised by the rapid and unexpected events in spring 2020 associated with the Covid-19 outbreak. Indeed, face-to-face teaching in medical schools has been replaced to e-learning modalities. Anatomists around the world have responded by necessarily forcing their students to study remotely, challenging their resources (Evans et al., 2020; Ravi, 2020; Harmon et al., 2021) generating sometimes a psychological impact (Cuschieri and Calleja Agius, 2020; Smith and Pawlina, 2021). Also, surgical education has embraced e-learning modalities by joining live webinar and lectures, increasing and evolving even the use of social media platforms (Laurentino Lima et al., 2020).

As in other universities, at the University of Genova (UniGE) the first wave of Covid-19 pandemic led to the cancelation of in-person teaching between February and July 2020 (Parmigiani et al., 2020). With the emergence of the second wave, UniGE has prolonged the remote teaching at least until April 6th, 2021 as imposed by the Italian Law No. 30 of 13 March 2021. In this letter, we comment on the current Covid-19 situation in medical education in our University with particular emphasis on anatomy and surgery teaching.

In the recent past, medical lecturers had already developed innovative computer-based methods (Frascio et al., 2009) but reluctance of teachers to completely move to digital modes constituted a barrier for development of these modalities. Covid-19 clearly transformed education methods as we quickly moved to Zoom (Zoom Video Communications, Inc., San Jose, CA) and Microsoft Teams (Microsoft Corp., Redmond, WA), or other videoconferencing platforms and students were forced to practice remote learning and social distancing (Allsop et al., 2020; Armstrong-Mensah et al., 2020; Franchi et al., 2020; Pather et al., 2020; Böckers et al., 2021).

Anatomy is the oldest scientific discipline of medicine and has been always very close to surgery. The first documented scientific dissections on the human body were carried out in the third century B.C. in Alexandria, Egypt. Then, although anatomy dissection was not officially illegal, social authorities rejected the dissection of human corpses until the 13th century (Ghosh, 2015). A change in attitude only happened during the 13th and 14th century when teaching consisted primarily of lectures from the canonical works of Galen, without verification through actual dissections (Ghosh, 2015). During Renaissance, Leonardo da Vinci (1452-1519) did practical work in anatomy on the dissection table in Milan, at hospitals in Florence and Rome, and in Pavia, where he collaborated with the physician-anatomist Marcantonio della Torre (1481-1511). By his
own count Leonardo da Vinci dissected 30 bodies in his lifetime, contributing to anatomical studies with the famous anatomical drawings, which are among the most significant achievements of Renaissance science. In the 19th century, with the development of effective surgical techniques throughout the world war and, later, the introduction of anesthesia, knowledge of the body components began to have a real practical significance for medical doctors, mainly for surgeons (Robinson and Toledo, 2012). Throughout the 20th century, dissection of the human body served as an initiation rite for first-year medical students, even as the research focus in the field began shifting from gross to microscopic and then ultrastructural anatomy (Shaffer, 2004). In particular, with the birth of light microscopy and then of electron microscopy in the last century, the knowledge of functional ultrastructure has opened new avenues in normal and pathological anatomy. Although fundamental for medical students, notably for those intending a surgical, pathological and/or neurological career, a decline of anatomy as basic discipline is observed (Singh et al., 2015). Practical laboratories with dissections have been discontinued in almost every Italian medical schools including UniGE, due to ethical and costs reasons and few new anatomists are being trained (Frati et al., 2006). But yet, gross anatomy is still considered a prime learning issue in the operating room and most medical students are amazed by the extent to which the real body differs from the images in their textbooks. The devaluation of the importance of anatomy, in combination with an increased emphasis on early clinical practice and decreased time for basic science (Kahn et al., 2011), is forcing a rethinking of the way in which anatomy is taught (Keim Janssen et al., 2014, Darici et al., 2021, Evans and Pawlina, 2021). The accurate knowledge of anatomy is still cardinal in understanding the technique of every surgical intervention and to improve the learning curve of even low complexity surgery (Merola et al., 2020). During the last years, digital animation of human bodies has undergone massive advance for both anatomy and simulation-based training for surgery. In the field of simulation, recent experiences showed the potential of Information and Communication Technology (ICT) as a training strategy. Indeed, mixing medical and engineering skills could also boost non-technical skills like reaction capabilities and situation awareness useful to better cope with disaster emergencies (Frascio et al., 2019). In the field of anatomy, digital anatomy classes are now an ensemble of 3D virtual simulations and video tutorials on virtual or real filmed dissections combined with high resolution 2D images (Fredieu et al., 2015; Azer and Azer, 2016; Saverino, 2021). Notwithstanding these advances, well appreciated by trainees, our teaching community perceived that in-person
experience to observe macroscopic and/or microscopic anatomical specimens would engage the students more than virtual reality.

From a scientific perspective, Covid-19 additionally raised several considerations on which subjects really matter for medical students. As an example, electron microscopy imaging has proved to be paramount to recent SARS-COV-2 microscopic research. From resolving the SARS-CoV-2 spike protein and the 3D ultrastructure of the virus (Yao et al., 2020), research laboratories around the world are operating closely with electron microscopists to study the cellular modifications induced by the infection at the tissue and cellular level. However, it is worrying to notice that publications that show the presence of putative severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by electron microscopy (EM) in patient tissues are often misinterpreted with different cellular structures (Dittmayer et al., 2020). Correct identification of tissues and cellular structures in electron microscopy powerfully depends on the knowledge of anatomy and cell biology elements. Nowadays, only specialized cell and structural biology laboratories make use of high-level EM facilities, because they need highly specialized scientists and expensive instrumentation. This attitude determined an irreversible loss of expertise among pathologists that currently becomes dramatically evident during the SARS-CoV-2 pandemic (Dittmayer et al., 2021). From the educational viewpoint, showing to a class of medical students’ ultrastructural pictures derived from SARS-COV-2 human lungs obtained by cryo-biopsies in our university, seriously impressed the scholars. Those micrographs immediately raised the attention of students that came up with many fascinating queries. Thus, Covid-19 forces us to rethink the basic role that anatomy plays in the student’s life and future, irrespective of the type of career they will choose.

Ultimately, the remote teaching experience taught us that a combination of blended learning including online sessions and practical off-line experience will certainly be an innovative element to be considered in the near future of medical education (Jones, 2021; Ross et al., 2021). As an additional transformation, structuring advanced courses combining the practical learning of anatomy, from gross to ultramicroscopic, and surgical-based approaches, would bring out the best from students.

While the entire academic community is resettling into the “new normal” and learning to cohabit with Covid-19, the result of this experience is that the issue became an opportunity as we learned the transformative potential of those practices and, doubtless, they will be more and more employed in medical education.
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