Where variations are most important: How to teach human anatomy to medical students

Peter Kiss

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EDITORIAL

There are many major or minor variations in human gross anatomy, which can significantly affect the outcome of medical procedures, or quite often can cause different conditions in patients. Maybe „corona mortis" (the crown of death) is the most well-known variation, which is being taught to medical students. Corona mortis is usually characterized by the varied origin of the obturator artery. In case of corona mortis, it originates from the external iliac (or the inferior epigastric) artery, instead of the internal iliac. Sometimes there is an anastomosis between the inferior epigastric and the obturator artery. Regardless of the actual variation, this situation creates an artery loop right behind the superior branch of the pubic bone, in close relation to the inguinal canal. As such, corona mortis can cause significant problems for surgeons operating in this area, like an anterior approach to the acetabulum during hip surgery or even when fixing inguinal hernia.

Generally speaking, despite the many examples of clinically relevant anatomical variations, the knowledge given to students about these different variations in most medical schools is very limited. Most textbooks mention selected variations, some even give clinical case reports to underline the importance, but in the actual teaching and learning process, students and teachers also tend to minimize the involvement of variations. Making this situation even worse: different variations, even major ones affecting the structure, are simply ignored in the exams. We simply tend to focus only on typical textbook situations. The variations are only explained to "spice up" a lecture. Partly because of this, clinicians can often rightfully accuse anatomy teachers for not preparing students well for their courses.

We can all agree that the important purpose of learning anatomy in medical school is not only to learn the medical terminology, but also to acquire a flexible knowledge of human body structure that can be adapted to the actual situation. Every case, every patient carries her or his own personal version of the anatomical structure of a human, making everyone unique. How can we best prepare our students for this?

I am convinced, that the answer to this is, that there are no alternatives to dissecting actual human specimen.

In our modern age, where massive amount of information can be found in a very quick and easy way, and everyone can get access to this enormous amount of data, it is hard to justify such a teaching method, which is slow paced, requires a lot of infrastructural background as well as human resources, deals with ethical challenges. To some, dissection of cadavers may appear to be outdated and old-fashioned.

Still, dissecting as many human cadavers as possible during anatomy courses is the only true way to develop the skill to quickly assess and adapt to the situation, and change the procedure if needed.

The question may arise: in what way should medical students be introduced to dissecting human bodies?

There are many universities across the globe where there is very limited cadaver supply, and donated bodies are used for many years. In these cases, students only see already dissected specimen. In some universities there are absolutely no human cadaveric materials at all, only models and software are available to teach and learn anatomy. There are also medical schools (including the one myself is working at), where body supply is luckily not limited to such extent.

In our Department there are lab classes in the anatomy course for small goups of students, where teachers demonstrate the details on pre-prepared specimen, and on other classes teachers dissect the cadavers or other demonstration material in front of observing students. Classes are also offered to students where they themselves dissect cadavers under supervision of a licensed teacher. We also have open hours in the dissecting rooms before and during exam period to practice for the exam, but there no consulting teacher is available (due to lack of human resources). We carry out strictly oral exams, where students have to answer not only theoretical questions but also have to present their knowledge in practice, at the body as well. Based on the experience of our teaching staff, and also on feedback from our previous students, we can state that the more human material students encounter, the more they are allowed to dissect themselves, the better their skills become in human anatomy and medicine in general. Seems that the old philosophy: "I feel called upon to ask you to dissect as much as possible" – John Hunter (13 February 1728 – 16 October 1793) still applies for today.

Still, there is plenty of fields, which can be done much better. How can we evolve ourselves in teaching anatomy regarding variations?

First of all, leaders of anatomy departments, teachers and course directors need to consider consulting with clinicians. When putting together teaching schedules and lab class topics the most relevant anatomical variations for each specialty should be considered, and if possible be explained and demonstrated to students. Since diagnostic imaging and surgical technique is rapidly evolving, anatomy should also be updated, and kept up-to-date with these things.

This short list of common or rare anatomical variations could be considered to be worth to be taught in regular anatomy classes for medical students (not including those, which can be considered as developmental malformations):

1. Variations in the Circle of Willis: huge neurologic and neurosurgical significance. The typical textbook situation is reported to be present in only 34, 5% of the cases (1). The most common variations are the asymmetry of vertebral arteries and variations of posterior communicating arteries.
2. Missing dorsalis pedis artery: in a study otherwise healthy young individuals have no detectable pulse in the dorsal pedal artery (2).
3. Internal carotid artery pseudoaneurism inside the sphenoidal sinus (3).
4. Cervical ribs: sometimes contributing to thoracic outlet syndrome.

Department of Anatomy, University of Pecs Medical School (UPMS), Hungary.

Correspondence: Dr. Peter Kiss, Associate Professor, Department of Anatomy, University of Pecs Medical School (UPMS), Hungary, Tel: 3672536000; e-mail: peter.kiss@aok.pte.hu

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5. Linguofacial trunk: common origin of the lingual and facial arteries – relevant for head-neck surgery.
6. Arteria lusoria: Aberrant right subclavian artery (ARSA) might cause esophageal compression and subsequent dysphagia.
7. Variations of the coronary artery branches: as ischemic heart disease is one of leading causes of death in the world, this topic cannot be highlighted enough.
8. Variations of the liver anatomy: Riedel's lobe (4), hepatobiliary or Calot's triangle, varied intra- and/or extrahepatic bile ducts.
9. Variations of the cecum and appendix: peritoneal relations and positioning of the appendix.

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