Discussion and Consideration about the Teaching of Sectional Image Anatomy for Medical Postgraduates

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Abstract: Graduate education is an important carrier of world-class universities. Sectional image anatomy is a bridge course of medical graduates between medical basic and clinical research, Reformation of teaching is conducive to the cultivation of innovative talents. Teaching contents include: 1. Focal point on CT cross section images, with supplement of multi-plane images of CT, MR and the continuous section-images; 2. Introduction of the latest research results and progress; 3. Increase relevant knowledge of research direction and the anatomy application. It is emphasized the bases of systematic anatomy and regional anatomy, the combination of specimen and image anatomy and the objection of clinical application and research. Teaching methods should be the combination of traditional classroom and flipped classroom, and the complement of experimental classroom and research classroom. Teaching evaluations include the drawing homework + experiment operation and test + application discussion and written examination. Finally, there is an analysis of examination results + feedback questionnaire + research application. The teaching reformation of sectional image anatomy will improve the postgraduates ability of three-dimensional anatomical thinking, clinical application and interdisciplinary research.

1. Introduction

Sectional imaging anatomy is a basic course or bridge course of clinical medicine in medical colleges. It is a branch of sectional anatomy and bases on the systematic anatomy and regional anatomy, and it studies the anatomy by means of the sectional image. As a method of studying human anatomy, sectional anatomy has a long history. Until 1960s, with the appearance and development of modern imaging technology, the sectional imaging anatomy appeared, it can display and observe the structure of human organs from multiple or arbitrary directions. It is very easy to obtain multi plane sectional images and three-dimensional imaging and molding, and to realize the measurement and research of sectional and three-dimensional anatomy of living organs or systems, which is conducive to the cultivation of three-dimensional anatomical thinking of clinical postgraduates. The development of this subject has laid a foundation for clinical diagnosis and research of accurate anatomy. The teaching and research of sectional image anatomy has provided a guarantee for the cultivation of three-dimensional anatomy, thinking and memory for clinical postgraduates, and the sectional image anatomy has the good development potential and great application prospect [1-5]. As a clinician or clinical researcher, on the basis of the systematic anatomy and the regional anatomy knowledge, they should also have the corresponding sectional anatomy knowledge to meet the development needs of modern medical diagnosis and research [6-10]. The current situation in China is that the sectional anatomy research center of Shandong University, which can offer the courses of sectional anatomy and imaging diagnosis for the students of eight-years clinical medicine, and offer the sectional anatomy for the students of seven-years clinical medicine, and for the five-year clinical medicine as the elective course. The national top-quality course of imaging anatomy of Qingdao University is a comprehensive course for undergraduates majoring in clinical medicine and medical imaging, it include the X-ray anatomy,

CT Anatomy and sectional anatomy. Sectional anatomy is a three-dimensional or multidimensional sectional problem involving ultrasound and MRI, which is image anatomy The important foundation and components of. At present, due to the limited teaching conditions, most medical colleges can only offer sectional anatomy alone, while the anatomy teaching and Research Office of Qingdao University has offered a course of image anatomy with complete contents. In recent years, many medical colleges and universities in China have offered the course of sectional anatomy, and our university has also offered the course of sectional image anatomy for medical master and doctoral students. Through several years of the teaching practices and theoretical researches, this paper discusses the teaching content of sectional imaging anatomy and related issues of teaching system construction [1,4-5].

2. Teaching Content Reformation

The reasonable teaching content is very important for the teaching of tomographic anatomy for master and doctoral students, especially the selection of teaching materials. First of all, according to the basic teaching requirements, the syllabus, class hours, teaching objects, subjects and research directions are formulated. Arranging reasonable teaching contents according to teaching objects is an important part of course and the construction of the teaching system [11-13].

2.1. Textbook

The content of the textbook should reflect the basic theory, basic knowledge and basic skills, and have the requirements of reasonable, systematic and scientific content. The sectional anatomy was selected, it was published by people's Health Press and edited by Liu Shuwei, and the practical image anatomy was selected, it was edited by Duan Shaoyin and published by Wuhan University Press. The special subjects of sectional image anatomy were supplemented, such as the research progress of image anatomy about the atlantoaxial joint, the internal carotid artery and the clinical application and research about the imaging anatomy, the teaching effect is very good.

2.2. Highlight

In the teaching of sectional image anatomy, CT sectional image is the main part, focusing on the head, lung, liver and pelvis, supplemented by the requirements of the knee joint, shoulder joint, eye, ear and throat, and the research progress of atlantoaxial joint, internal carotid artery and skull base structure is increased. The key contents are the introduction of the shape, position, size and adjacency of the surrounding related structures of the key structures, as well as the change rule in the continuous section of important structures or organs; of the features in the best display section; of the observation of three-dimensional anatomy and model. At the same time, with the review of relevant systematic anatomy and regional anatomy content, students should master the important structure of sectional anatomy, construct the three-dimensional anatomical thinking, and realize the comprehensive understanding of the relevant knowledge and application.

2.3. Teaching equipment

Teaching equipment includes physical specimen and sectional picture, structural poster and teaching model, CT sectional picture and 3D printing model, which were used in the teaching process of sectional image anatomy. The focus is to observe the CT section pictures, supplemented by CT and Mr continuous layers, physical specimens or pictures and wall charts. Through the morphological observation of specimens, we can know and understand the morphological characteristics of each organ structure and the relationship between the surrounding structures, especially the observation of three-dimensional images and three-dimensional printing models, which has a sense of reality and three-dimensional sense of organ or structure, and is conducive to the cultivation of three-dimensional anatomical thinking ability. This is an important part of postgraduate teaching and training, to realize and understand the position, size and other three-dimensional forms of a structure or organ in systematic anatomy, and then transform them into cross sections, and build the relationship between cross sections and three-dimensional structures.

There are great differences between 3D printing model and specimen structure, image fault pictures, etc., but they are inseparable and interrelated. Therefore, the specimens, models, multi- plane faults and three-dimensional images are carefully compared and observed to form three-dimensional thinking. Based on the structure of physical specimens, the structure of image faults is understood, and the cross-section and three-dimensional display and identification of anatomical structures are completed.

2.4. Introduction to technical progress

There are new technology and method applications in research of tomographic anatomy, such as 3D imaging technology, digital human body building, 3D finite element modeling and simulation, 3D rapid prototyping, etc. the application of various new imaging diagnosis instruments in clinical diagnosis and treatment is conducive to graduate students to understand the development of sectional anatomy and sectional imaging anatomy, and application of anatomy in related to clinical departments. In the course of teaching, it is found that graduate students of surgery, interventional therapy and medical imaging are interested in sectional image anatomy, which provides a good anatomical basis for the future professional study and project design and research.

2.5. Practical training course

After theory course, practical course would start in the demonstration room and use the data of teaching system and PACS of the affiliated hospital. It include the extracurricular lectures and subject teaching, which data from the website or medical journal, in order to introduce the basic knowledge and application about sectional imaging anatomy. It is to increase the learning of the subject knowledge, complete the related basic and bridge knowledge of the subject, and understand the new progress and clinical application. In order to supplement the lack of theoretical class hours, the important knowledge were strengthen in the practical course. The main purpose of practical course were to find out the images of normal anatomy or common and frequently occurring diseases by themself according to their needs, to use the self-study software of the diagnosis process and simulate the diagnosis according to the standard image analysis and diagnosis process during the self-study. At the same time, the teaching system is attached with the simulation question bank to self-test for students according to their own learning progress, which can evaluate their mastery level through the simulation test.

3. Construction of the Teaching System

teaching system is a unified whole composed of knowledge structure, framework, teaching content, teaching method, teaching process and teaching evaluation, including the teaching sequence, process, method, form, content, feedback, evaluation, summary, comparison and derivation and a series of teaching elements. At present, there are few courses for medical postgraduates. The teaching system related to sectional anatomy is worth further practice and experience summary [14-16].

3.1. Curriculum arrangement

According to the requirements of the Ministry of education, our school has formulated the curriculum standards applicable to clinical medicine graduate students, including doctoral students and sectional image anatomy. There are 32 courses in total, including 22 theoretical courses, 8 practical courses and 2 examination hours. It is suitable for the current multi-disciplinary technology and foundation of clinical medicine. Relevant knowledge is very important in clinical diagnosis and treatment, especially in medical imaging, surgery and interventional treatment. In view of the contradiction between more content and less class, it is clear that the main framework knowledge should be included in the theory course, while the contents of imaging technology, image observation and the continuous imaging display were put into the practical courses.

3.2. Frame construction

Through the general course, introduce the frame composition of sectional image anatomy system, help students to establish the concept of sectional image, introduce the imaging principle and main clinical application direction of CT based imaging equipment. According to the key structure of each system, the image display is mainly CT cross-section, supplemented by MR multi-plane or US cross-section. Finally, CT and MRI multi-plane images and three-dimensional images are selected for the special lecture.

3.3. Teaching methods

First, comment on the assignments of the last course, then introduce the key of the theoretical course. Based on the system anatomy and regional anatomy, The theory course was taught, starting with the typical section image of CT in thickness 5mm and comparing with the specimen section, supplementing by the wall chart of anatomy, and identifying the key structure and describes the relationship between its surrounding structures. The teaching mode of PBL (problem centered) was combined. Finally, the continuous CT images of key structures were observed and discussed. Then, 1-2 thinking questions were put forward, in order to gradually improve the students' ability of thinking, reasoning and independent learning. Finally, to summarize course and arrange drawing homework, it will lay a solid foundation for the next course through such training and learning.

3.4. Basic theory and ability training

Sectional anatomy covers many disciplines. It has greatly progress with the development of imaging equipment and technology, and the related disciplines is also powerfully promoting its development. No matter how long students spend and how hard they work, the contents they mastered are still limited. What they learned in the theory course will soon be forgotten. Because of this, it is very important to cultivate their ability of learning, understanding and three-dimensional thinking. That is to say, the purposes of setting up the sectional image anatomy are to consolidate the basic knowledge, form three-dimensional imaging memory and digest or update the related knowledge, and realize the application in the clinic and research.

3.5. Lecture or heuristic teaching

With development of computer software and hardware related teaching, the multimedia teaching has been extensively adopted. Teaching mode can be divided into the lecture teaching and heuristic teaching. The former is that teacher first interprets the basic principles, concepts and definitions, such as the definition of niches, filling defects and image signs, attached with images and text descriptions to deepen the understanding of basic knowledge, so that students can learn effectively. The latter, teacher first give some questions, then students have searched and studied by the teaching system, internet and library. The teacher can answer individual questions in time, or present common problems through the projector and summarize them. The teaching style is active for teachers, passive for students, easy to control for class hours, suitable for learning basic principles, concepts and definitions. Heuristic teaching should be guided by students and teachers, and pay attention to the learning process, so as to improve students' ability of analysis, self-study and application of image knowledge. In the actual teaching process, those contents are suitable for lecture teaching and those contents are suitable for heuristic teaching. How to combine two methods and to achieve the complementing effects, it needs to be further explored and improved.

3.6. Examination and assessment

The course comprehensively evaluates the examination results of students by drawing homework + experimental operation and face-to-face examination + written examination. Through the analysis of students' achievement, the feedback of students' questionnaire and the research and application of long-term projects, the learning effect and evaluation of the course can be realized. Obviously, it emphasizes the students ability of learning and using knowledge, rather than focusing on the assessment of how much knowledge or skills students have remembered. The examination can only

reflect the results of teaching and learning in a certain period, not the ability of students to apply new knowledge and skills, as well as the ability of students to relearn and the great potential for development. Therefore, how to assess the effect and potential of students' learning knowledge and skills, that is not one of the problems concerned in the teaching, and also the need of evaluating the effects of short-term and long-term effect for the teaching.

4. Existing Problems and Countermeasures [19-20]

4.1. Similar terms, overlapping contents or repetition

Relevant terms or names of this course are as follows: sectional anatomy, sectional imaging anatomy, human sectional anatomy, imaging anatomy, human sectional imaging anatomy, imaging sectional imaging anatomy, imaging sectional imaging anatomy, human sectional imaging anatomy, etc. Looking at the characteristics of the course name, discovery is two parts, the first is sectional anatomy, the second is image anatomy, and the third is sectional anatomy. The concept of anatomy is the same, but the difference is the concept of specimen section, image section and X-ray composite image. Therefore, it is suggested that different course names or subject names should be set up for different majors and educational levels. As for sectional anatomy, it should include sectional anatomy of specimens and sectional anatomy of images, which should include X-ray anatomy, sectional anatomy of images and three-dimensional sectional anatomy of images. At last, it is found that sectional anatomy and image anatomy involve the much content, while the sectional image anatomy is relatively less.

4.2. Confusion between course content and teaching object

There is no need to aim at different teaching objects according to different course content, such as different educational levels or different majors. The subjects of sectional anatomy and image anatomy are three-year doctoral and master's degree in medicine, eight-year and seven-year clinical medicine, five-year clinical medicine and medical imaging. I feel confused. It's worth discussing. Sectional anatomy and sectional image anatomy are important supplements of anatomy and basic courses of medicine, which can cultivate students' three-dimensional sense and three-dimensional thinking. Image anatomy is a professional basic course of medical imaging. It has the ability to train students' image thinking and three-dimensional thinking, which is the content that image students must master. The content selection of courses should be adjusted and selected according to different educational levels, learning objectives and requirements. Clinical medicine should focus on sectional anatomy and imaging medicine should focus on imaging anatomy. Different levels of education can choose different content and depth. Graduate students emphasize the need of research, the scope of learning should be smaller, the professional knowledge should have depth, and there should be three-dimensional thinking of application; undergraduate level focuses on cultivating three-dimensional anatomical concept, emphasizing the recognition and memory of anatomical structure. The contents of course should pay attention to sectional anatomy, which should be based on the specimen section, supplemented by the image section. Image anatomy focuses on the X-ray anatomy and image section, supplemented by specimen section. If the key contents of course are not unified, relevant adjustments shall be made according to the specialty of students.

4.3. Examination and Test

Most schools assess the students with testing the memory of anatomical knowledge by written examination, which fail to assess the students' application ability of anatomical knowledge, three-dimensional concept and three-dimensional thinking. The task of course learning is training students' learning ability and application ability. Written examination is no assessment of students' ability, it is the defect of the current examination. Therefore, it is very important to establish the test focus of students with different educational levels. In the examination or examination of undergraduate course, the recognition and discrimination of anatomical structure should be emphasized, while in the postgraduate course, the application and thinking of anatomy should be

emphasized. Students of different majors should have different emphases. Clinical medicine focuses on sectional anatomy, while medical imaging focuses on image anatomy. The way of examination also has different requirements and test points, which need to be clearly defined. The examination is more suitable for undergraduates. Postgraduates should strengthen the effect of examination and experimental training.

4.4. Different sources of teachers

In the process of teaching, the source and training of teachers are particularly important. At present, there are different teachers and there are no clear requirements. Most of the college teachers are mainly from anatomy teaching and research section, surgery teaching and research section and imaging teaching and research section, which should be available. However, there are no clear regulations on Teachers' academic qualifications, professional titles and work experience, and there are no differences among different teaching objects. This is a problem that needs to be solved urgently. It is strongly suggested that the course should be biased to use anatomy teachers for sectional anatomy, but the course should be biased to use imaging teachers for sectional imaging anatomy and imaging anatomy. As for the requirements of teachers education background and professional titles, they should be selected according to the teaching objects. For example, for undergraduates, we choose those who have graduate education background and have professional titles with lecturers or senior profession. For graduate or doctoral education background, we need teacher have master or doctor degree with profession. For medical imaging majors, we need those who have master or doctor degrees with imaging background, who should be more suitable and will have better effect. As the current situation of university, we should decrease to use the low education and professional title teachers to participate in the teaching of postgraduates or doctoral students, that is not conducive to improving the quality of teaching, especially the cultivation of applied talents.

Reference

[1] Ghosh SK. (2017) Cadaveric dissection as an educational tool for anatomical sciences in the 21st century. Anat Sci Educ,10(3):286-299.

[2] Chen Y, Zheng K, Ye S, Wang J, Xu L, Li Z, Meng Q, Yang J, Feng ST. (2019) Constructing an experiential education model in undergraduate radiology education by the utilization of the picture archiving and communication system (PACS). BMC Med Educ,19(1):383-384.

[3] Grignon B, Oldrini G, Walter F. (2016) Teaching medical anatomy: what is the role of imaging today? Surg Radiol Anat,38(2):253-260.

[4] Rao libing, Yang Yinong, Xie Zhenglan, Xiang Changhe. (2013) Construction and thinking of sectional imaging anatomy laboratory [J]. Advances in anatomy,19 (05): 491-493.

[5] Liu Hongtao. (2013) Experience in the application of experimental teaching methods after the integration of sectional anatomy and image anatomy. Chinese society of anatomy. Proceedings of 2013 annual meeting of Chinese society of anatomy [C]. Chinese society of anatomy: Chinese society of anatomy, *pp*1-10.

[6] Sethna V, Siew J, Pote I, Wang S, Gudbrandsen M, Lee C, Perry E, Adams KPH,Watson C, Kangas J, Stoencheva V, Daly E, Kuklisova-Murgasova M, Williams SCR,Craig MC, Murphy DGM, McAlonan GM. (2019) Father-infant interactions and infant regional brain volumes: A cross-sectional MRI study. Dev Cogn Neurosci, 21;40:100721. [Epub ahead of print]

[7] Rowe SP, Chu LC, Fishman EK. (2019) Initial experience with 3D CT cinematic renderingof acute pancreatitis and associated complications. Abdom Radiol (NY). 2019 Nov 6. doi: 10.1007/s00261-019-02310-x. [Epub ahead of print]

[8] Sinha M, Pandey NN, Sharma A. (2019) Anomalies of the Coronary Sinus and Its Tributaries:

Evaluation on Multidetector Computed Tomography Angiography. J Thorac Imaging. 2019 Oct 29. doi: 10.1097/RTI.0000000000000456. [Epub ahead of print]

[9] Nguyen VP, Li Y, Aaberg M, Zhang W, Wang X, Paulus YM. (2018) In Vivo 3D Imaging of Retinal Neovascularization Using Multimodal Photoacoustic Microscopy and Optical Coherence Tomography Imaging. J Imaging,4(12). 150-151.

[10] Shen L, Zhao W, Xing L. (2019) Patient-specific reconstruction of volumetric computed tomography images from a single projection view via deep learning. Nat Biomed Eng, 3(11):880-888.

[11] Smith CF, Tollemache N, Covill D, Johnston M. (2017) Take away body parts! An investigation into the use of 3D-printed anatomical models in undergraduate anatomy education. Anat Sci Educ, 11(1):44-53.

[12] Estai M, Bunt S. Best teaching practices in anatomy education: (2016) A critical review. Ann Anat, 208:151-157.

[13] Li Ling, Shen ruowu, Sun Yu, Xia Yujun. (2018) Application of virtual orthogonal fault and its three-dimensional model in the teaching of fault image anatomy [J]. Journal of anatomy, 41 (04): 490-491

[14] Fu Hui. (2011) Discussion on the construction of digital platform and the teaching reform of sectional image anatomy. Proceedings of the third national anatomical Technology Conference, *pp*15-25.

[15] Gao Hengyu, Jiang Yang, Guo Linna, Hou Jiye. (2010) The practice and research of clinical film library in the teaching of image anatomy and sectional anatomy [J]. Anatomy research, 32 (04): 306-307.

[16] Qiu Mingguo, Liu guangjiu, Li Qiyu, Li Zhenqiang. (2009) Teaching experience of sectional image anatomy [J]. Journal of local surgery, 18 (03): 194-195.

[17] Wu Y, Hikspoors JP, Mommen G, Dabhoiwala NF, Hu X, Tan LW, Zhang SX, Lamers WH. (2019) Interactive three-dimensional teaching models of the female and male pelvic floor. Clin Anat,2019 Oct 22. doi: 10.1002/ca.23508. [Epub ahead of print].

[18] Qin Y, Zhu W, Liu C, Wang Z, Zhu W. (2019) Functional brain connectome and its relation to mild cognitive impairment in cerebral small vessel disease patientswith thalamus lacunes: A cross-sectional study. Medicine (Baltimore), 98(40): e17127. doi:10.1097/MD. 0000000000017127.

[19] Liu Shuwei. (2004) Welcome the new era of tomographic anatomy [J]. Chinese Journal of clinical anatomy, (05): 455-456.

[20] Qiu Mingguo, Zhang Shaoxiang, Tan Liwen, Li Qiyu. (2004) Strategies for strengthening the teaching of sectional image anatomy [J]. Journal of local surgery, 2: 113-114.