Investigation of Teaching Gallery in Clinical Teaching of Ultrasonic Medicine

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Abstract

In the course of ultrasonic medical teaching, disease images are indispensable. However, the randomness of real-time teaching case resources often affects the smooth development of clinical ultrasound teaching. Based on the picture archiving communication system, the audio-visual images and clinical data of cases were collected and the teaching gallery was established. The gallery can be used for teaching common diseases, rare diseases, new ultrasonic technology and interventional ultrasound to ensure that the teaching content is consistent with the teaching process. It can overcome the uneven distribution of diseases, some patients poor teaching compliance and other practical clinical teaching problems, so as to improve the effect of ultrasonic clinical teaching.

Keywords: ultrasonic medicine, gallery, teaching, picture archiving communication system

With the rapid development of imaging technology, new ultrasound technology has emerged at the historic moment, and the scope of clinical application of ultrasound has become more and more extensive (Wang & Zhang, 2022). Based on this, higher requirements are put forward for ultrasound medical teaching. However, in the actual clinical teaching, due to the short practice time, uneven distribution of diseases, patient privacy protection, some teachers do not have strong awareness of teaching, etc., the teaching effect is uneven. The emergence of Picture Archiving Communication System (PACS) converts medical image data into digital information and realizes resource sharing. Establishing ultrasound teaching library based on PACS and applying it to clinical teaching can enrich teaching resources and improve the teaching quality of ultrasound clinical teaching.

1. Current Situation of Clinical Ultrasound Teaching

1.1 Ultrasound examination is convenient, high safety, occupies an important position in clinical diagnosis and treatment, and is one of the auxiliary examinations of clinical choice. Ultrasound medicine is a professional and highly practical subject, covering anatomy, clinical, imaging and other disciplines. In the case of many contents and relatively few class hours, how to teach effectively is the difficult point in the teaching of ultrasound medicine. However, the basic knowledge of ultrasound is abundant and boring, and the ultrasonic images in the textbook are small in number, poor in definition and lack of dynamic images, so students are not enthusiastic in learning and it is difficult to master the knowledge. The practice of image recognition and operation is an important supplement to the theory of ultrasound medicine. The teaching quality of the teaching practice determines the final teaching effect to a certain extent.

1.2 In the previous teaching process of ultrasound department, the traditional teaching mode was mostly adopted, which was taught by the teacher, and the students followed the teacher to observe and operate on the computer in the consulting room. The types of diseases exposed were scattered and random, and the teaching and teaching process of the cases were not necessarily synchronized, so the students' enthusiasm for learning was not high, and the teaching effect was not good (Huang & Zhao, 2020). In addition, with the increasing awareness of patients' privacy and rights protection (Liu, Xu, Yang, Luo, Zhou, Deng, … Dai, 2019), students of gynecology, andrology and breast diseases cannot observe them all. All these have increased the difficulty for the clinical teaching of ultrasound department.

2. Teaching Gallery Establishment

2.1 Image storage and transmission system is a comprehensive image management system, including input part, image database, image processing workstation, etc., with advantages such as high image quality, convenient storage, and resource sharing (Gong, Hong, Liu & Wu, 2022), image data can be effectively managed and fully utilized (Wang, Yu, Yuan, Jing, Hu & Fang, 2022). However, PACS system has a huge memory reserve, and students are often at a loss in the face of massive pictures and data, so it is necessary to screen and establish a special teaching gallery.

2.2 Method: Based on PACS and combined with the electronic medical record system of our hospital, clinical real cases were selected according to each subspecialty of ultrasound (heart, abdomen, superficial, vascular, etc.), and clear and complete medical history, ultrasound images (including dynamic and static images), laboratory test results and other imaging results were selected. To construct a typical case library for ultrasound medical imaging teaching. Ten cases were selected for each disease. Teachers demonstrate and explain to students during clinical teaching. At the same time, apply to the information Department for a special account for students to conduct independent learning.

3. The Application of Teaching Gallery

3.1 Common Disease

Ultrasonic diagnostics is a highly practical subject with abstract and complex theoretical knowledge. Different diseases can be represented by the same or similar ultrasonic images, while the same disease can be represented by different ultrasonic images, namely, "same disease anomaly, same disease anomaly". It is difficult for students to grasp knowledge by theoretical teaching alone, but the teaching of picture library in clinical teaching can help students understand and master relevant knowledge. Hepatic hemangioma is a very common disease in clinical practice. On ultrasound, hepatic hemangioma is mostly manifested as hyperechoic or isoechoic lesions in the liver. In patients with fatty liver, it can be manifested as hypoechoic lesions in the liver, which is the "same disease anomaly". "Different diseases with the same image" means that different diseases such as liver cancer, hepatic hemangioma, focal hyperplastic nodules of liver, and hepatic adenoma can all be manifested as hypoechoic lesions in the liver, which should be differentiated by combining medical history, laboratory examination, and other imaging examinations. When teaching, teachers can use the teaching image library to present the corresponding ultrasonic images of "same disease and different image, different disease and same image" at the same time, overcoming the problem of randomness of diseases in rotation learning.

3.2 Rare Disease

Although teaching hospitals have a large number of patients, the distribution of diseases is not necessarily uniform. In addition, the group management mode of our hospital is multi-hospital, and the clinical specialties set up in each hospital are different, and the distribution of diseases is also different. Especially some specialty rare disease, difficult disease or rare disease. For example, breast tumors and liver tumors are common diseases that students can often encounter, but heart tumors are rare diseases with an incidence of about 0.05%-1%, which is more difficult to encounter. There are also breast amyloidosis, Kimura disease, gastrointestinal stromal tumors that metastasize to the liver, which are clinically rare, while students' interest in rare diseases is extremely high. In the process of clinical teaching, the use of teaching gallery can make up for the low incidence of some diseases, so that students can learn and understand the ultrasonic manifestations of rare diseases, so as to achieve the comprehensiveness of teaching content as much as possible.

3.3 New Ultrasonic Technology

With the continuous development of computer and electronic technology, ultrasound has changed from the simplest two-dimensional imaging to three-dimensional or even four-dimensional imaging, from simple anatomical morphology imaging to molecular and functional imaging. In recent years, with the emergence of new ultrasound technologies, it plays an increasingly important role in clinical diagnosis and treatment (Li, Peng, Deng, Xu, Ye & Hang, 2017), such as contrast-enhanced ultrasound, shear wave elastography, automated breast volume scanning, superb mircovascular imaging, etc.

During clinical practice, not every student can see the teachers using the new ultrasound technology to diagnose diseases. Through the teaching gallery, each student can learn the application of different new ultrasound technologies in disease diagnosis, so as to have a deeper understanding and recognition of the application range of ultrasound, and stimulate students' enthusiasm for learning. For example, thrombosis in the apex of the heart is found by left ventricular contrast echocardiography (Cotter, Raisinghani & DeMaria, 2022), and the stiffness of the diseased muscle is measured by shear wave elastomography (Analan & Aslan, 2023).Superb

mircovascular imaging was applied to understand the situation of focal microvessels (Kurt, Kayadibi, Saracoglu, Ozturk, Korkmazer, Cerit & Velidedeoğlu, 2023), and three-dimensional automatic breast volume imaging was applied to diagnose breast diseases (Sherchan, Liang, Sherchan, Suwal & Katwal, 2024). Through understanding the new ultrasound technology, it is helpful for students to choose reasonable examination means in clinical application in the future ,better serve patients.

3.4 Interventional Ultrasound

At present, ultrasound has been transformed from independent diagnosis to diagnosis and treatment, and the application scope of ultrasound medicine has been further expanded (Zhai, Xu & Zhao, 2017). Interventional ultrasound is an important branch of modern ultrasound medicine. Under real-time ultrasonic monitoring or guidance, it can complete puncture biopsy, tumor ablation, aspiration, catheterization and drug injection to achieve the purpose of diagnosis or treatment. As a prospective clinician, students can have a certain understanding of interventional ultrasound during the internship, which is very helpful for future clinical work. Ultrasonic-guided thyroid fine needle aspiration biopsy refers to the use of fine needle (22-25G) under ultrasound guidance to puncture the thyroid nodule, obtain cellular components from it, and determine the nature of the target lesion by cytological diagnosis (Todsen, Bennedbaek, Kiss & Hegedüs, 2021).

In actual operation, due to the limitations of the site and the aseptic principle and other factors, students can not see the specific operation process clearly and pay attention to the key places, and the effect of teaching is not good enough. The teaching gallery can store dynamic videos and static images, and the instructor can explain the operation process and precautions to students while playing videos and viewing images, so that students can understand the ultrasonic technology of ultrasound-guided thyroid fine needle biopsy in detail. In addition, although interventional ultrasound has high safety, complications are sometimes unavoidable. The teaching gallery can present the images of the common complications of ultrasound-guided thyroid fine needle biopsy, such as bleeding, so that students have a more comprehensive understanding of this technology, which will help them carefully choose the appropriate diagnosis and treatment means in future clinical work.

4. Clinical Practice of Teaching Image Gallery

4.1 Teaching Objects

30 students (10 undergraduates and 20 postgraduates) in the ultrasound department from January 2022 to May 2023.

4.2 Teaching Methods

4.2.1 Small Lecture

The teachers give small lectures to the rotation doctors by using the teaching gallery, once or twice a week. Select one case from each disease in the teaching gallery to present in PPT form, including clinical history, physical examination, laboratory examination results and clear and complete ultrasound images, and set questions according to the case and teaching requirements, the ultrasound imaging manifestations of the disease were described from the longitudinal thinking of "clinical-image-diagnosis-pathology".

4.2.2 Mini Ultrasound Medical Competition

At the end of each month, a mini Ultrasound medical competition will be held, and the students will be grouped according to the number of students in the month. In the form of group confrontation, the form of the question can be single choice or multiple choice. The correct answer will add one point, and the wrong answer will not score. The teacher will select 10 cases from the teaching library, and each case will give corresponding medical history, laboratory examination and ultrasound image. Students will make diagnosis according to the given information, and the group with the highest score will win.

4.3 Evaluation of Teaching Effect

Questionnaire survey is adopted to evaluate the teaching effect of the application of teaching library. Each of the 30 students was required to complete a questionnaire at the end of the rotation, which included five parts and the answer could be yes or no. The results show that students generally have a high evaluation of the library teaching. Most students think that the teaching content of picture library is clear and easy to understand, which is conducive to the mastery of theoretical knowledge and the formation of clinical thinking, and the learning interest and participation are improved (Table 1).

Table 1. The questionnaire survey of teaching picture library [n(%)]

Evaluation content	Yes	No
The teaching content is clear and easy to understand	28 (93.3)	2 (6.7)
Conducive to the mastery of theoretical knowledge	22 (73.3)	8 (26.7)
Interest in learning is improved	27 (90)	3 (10)
High participation	24 (80)	6 (20)
Contribute to the formation of clinical thinking	25 (83.3)	5 (16.7)

5. Advantages and Limitations

5.1 Advantages

5.1.1 Break through the space limit of paper textbook pictures to meet the knowledge needs of students

Ultrasound medicine focuses on studying diseases from the angle of image and clarifying their essence. Image teaching plays an important role in ultrasound medicine teaching. Students rely heavily on teaching pictures in the learning process. However, at present, the number of pictures in the textbook is very limited due to the limitation of space and other factors, which is difficult to meet the learning needs of students. Therefore, the construction and application of ultrasonic medical teaching gallery can meet the students' knowledge needs to the greatest extent.

5.1.2 Break through the limitation of time and space in classroom learning, and realize that students can consult and study at any time after class and improve students' learning quality and efficiency

How to implement ultrasound teaching better has always been a difficult point in teaching. Many clinical ultrasound images presented in the traditional classroom can only be studied in the classroom, and students can not review or self-study after class, and it is difficult to link theoretical knowledge with actual diseases. Based on the network and multimedia technology, the ultrasound teaching gallery is established by teachers screening cases, selecting typical, clear and complete pictures, collecting clinical history and laboratory test results.It breaks through the time and space limitation of classroom learning, enables students to learn at any time after class and improves their learning quality and efficiency.

5.1.3 Improve students' learning interest, independent learning ability and clinical comprehensive analysis ability

Through the systematic study, diagnosis and related differential diagnosis of a large number of typical cases in the ultrasonic teaching gallery, students fully understand the etiology, pathological changes, clinical manifestations and the relationship between the ultrasonographic manifestations, which improves students' learning interest, independent learning ability and clinical comprehensive analysis ability, and also improves the learning effect and cultivates students' clinical thinking.

5.1.4 Provide teaching materials for teachers

When making teaching courseware, teachers urgently need a large number of high-quality ultrasonic pictures showing disease, but some of the pictures collected on the network are incomplete, indicating signs are unclear, and the clarity is poor. Using the teaching gallery, teachers can choose ready-made materials according to the learning progress, saving the time of preparing lessons. The construction of ultrasonic teaching gallery can also provide teaching materials for teachers and serve teaching better.

5.2 Limitation

The teaching gallery is based on the PACS system of the hospital, so it needs to be used in the hospital, and cannot be used outside the hospital. The library needs to be constantly updated to ensure that the cases and images keep up with clinical and ultrasound developments. Teaching gallery is one of the tools to assist teaching, and the teaching process cannot be separated from the teacher's guidance.

In conclusion, the rational use of image library teaching in ultrasound clinical teaching can simplify complexity and make obscure ultrasound terms into clear and easy to understand ultrasound images, which is conducive to students mastering the knowledge of ultrasound diagnostics and improving the teaching effect of ultrasound

medicine. The establishment of the teaching gallery solves the randomness of the diseases encountered in the course of rotation, and makes the content and progress of students' learning in the stage of rotation consistent with the teaching process. At the same time, through the presentation of rare diseases, new ultrasound technology and other related images, enrich students' understanding of a variety of diseases, while keeping up with the forefront of ultrasonic technology development, and better serve the clinical.

Acknowledgements

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