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Application of the "Microclass + Case Bank" Integration Model in Clinical Teaching of Neurology

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Abstract: Based on the current situation and dilemma of traditional clinical teaching in neurology, content design and case screening are carried out for the "microteaching + case database" integration model by establishing the development principles of microteaching resources and the construction standards of the case database. Then, we analyze from four stages: pre-class (microclass guidance + case pre-analysis), classroom teaching (microclass intensive lecture + case discussion), after-class practice (case simulation + microclass consolidation), and teaching evaluation (diversified assessment + feedback improvement). The application path of the "microclass + case bank" integration model in clinical teaching of neurology is helpful to cultivate the clinical competence of medical students in neurology and has important promotional value.

Keywords: Microteaching + case database; Neurology department; Clinical teaching

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1. Introduction

Neurology, as an important branch of clinical medicine, covers many diseases such as stroke, Parkinson's disease, epilepsy, and multiple sclerosis [1]. It is characterized by complex knowledge points, abstract anatomic-physiological mechanisms, and significant differences in individualization of clinical cases [2,3]. As a clinical discipline with strong logic and diverse disease manifestations, clinical teaching in neurology has always been the focus and difficulty in medical education. Although the traditional "lecture-based learning" and "case-based learning" models are widely used, they often face many dilemmas in practice, such as the abstract and boring theoretical lectures, and it is difficult for students to link scattered anatomical, physiological, and pathological knowledge with specific clinical symptoms; typical cases present spatiotemporal limitations [4], and bedside teaching is difficult to ensure that each student can reach a complete and typical diagnosis and treatment process; students passively accept knowledge and clinical thinking training is insufficient [5,6], and

the transformation efficiency from knowledge to ability is low.

With the deep integration of information technology and medical education, microcourses and case banks, as two effective teaching resources, have shown their unique advantages. Microcourses, with characteristics of "short and exquisite, clear theme and strong pertinence," can transform abstract medical knowledge into intuitive and vivid video content and facilitate students to learn independently using fragmentation time [7]. The case pool provides students with immersive clinical scenarios by integrating typical clinical cases and helps cultivate their clinical thinking ability [8]. The organic integration of the two can realize the deep integration of theoretical teaching and practical teaching, and provide new ideas for the reform of clinical teaching in neurology. Based on this, the purpose of this paper is to systematically construct a "microclass + case bank" integrated teaching model and application path in order to provide an operable reference paradigm for teaching reform in neurology and even other clinical disciplines.

2. Status quo and dilemma of traditional clinical teaching in neurology

Although great progress has been made in the cause of medical education in China, clinical teaching in neurology still faces many prominent problems, which are mainly reflected in the following aspects.

First, theory and practice are seriously disconnected [9]. Traditional teaching mostly adopts the separation mode of "classroom theoretical teaching + bedside teaching," the abstract neuroanatomy and pathophysiology knowledge in the classroom lacks clinical scene support, and students are difficult to understand its clinical significance. In bedside teaching, students are also unable to effectively associate cases with learned knowledge due to a weak theoretical foundation and cannot accurately locate and diagnose conditions, resulting in "learning two skins."

Second, cases are unevenly distributed and uneven in quality. Due to the influence of patient flow, case type, geographical medical level differences, and other factors in clinical departments, there are significant limitations in the cases exposed to students. On the one hand, it is difficult to comprehensively cover the different course stages of common diseases in neurology, especially the cases of rare diseases and difficult diseases; on the other hand, some teaching cases lack systematic collation, key information is missing, and it is difficult to meet the needs of standardized teaching.

Third, clinical thinking cultivation lacks systematicity and pertinence. In traditional neurology clinical teaching, students are mostly in a state of passive acceptance of knowledge [10], and teaching teachers tend to directly give diagnostic conclusions and treatment options and lack guidance for students' thinking process of "localization diagnosis–qualitative diagnosis–differential diagnosis–treatment decision." This "fill-duck" teaching leads to insufficient logic, organization, and criticality of students' clinical thinking, and is often impossible in the face of complex cases [11].

Fourth, insufficient cultivation of autonomous learning ability [12]. Under the traditional teaching mode, students' learning time is concentrated in classroom and bedside teaching, and there is a lack of targeted learning resources and guidance mechanisms after class, which is difficult to carry out personalized learning according to their own weak points. At the same time, the initiative and enthusiasm of students' independent learning have not been fully mobilized, and most of them rely on the homework arranged by teachers to complete the review, resulting in a poor learning effect.

Fifth, the teaching evaluation system is single. The traditional teaching evaluation is mainly based on the final examination (theoretical written examination, skill operation assessment) [13], which ignores the

evaluation of students' learning process, clinical thinking process, independent learning ability, and other dimensions and is difficult to comprehensively reflect students' real learning effect and comprehensive ability.

3. Basis for the construction of the integration model of "microclass + case database"

3.1. Development principles and content design of microcourse resources

3.1.1. Development principles

Microcourse resource development needs to follow three major principles: pertinence, practicability, and scientificity. Targeted principles require that microcourses closely center on the important teaching difficulties of neurology, such as the classification and diagnosis of cerebrovascular diseases, the key points of identification of Parkinson's disease, and the judgment of seizure types of epilepsy; practical principles emphasize that microcourses should be combined with neurology clinical practice to highlight the application value of knowledge, such as the operation process of lumbar puncture and the reading skills of head CT images [14]. According to the principle of scientificity, the content of microlectures shall strictly follow the medical specifications of neurology to ensure that the theoretical knowledge is accurate and the operation demonstration meets the clinical standards.

3.1.2. Content design

Neurology microteaching resources are mainly divided into three major modules: theoretical knowledge, skill operation, and case analysis. Theoretical knowledge microcourses focus on the explanation of abstract concepts, such as "function of blood-brain barrier," and help students understand memory through animation demonstration and schematic explanation; skill operation microcourses focus on clinical practice, such as "neurological physical examination steps" and "operating specifications for intravenous thrombolysis," and standardize students' operating procedures through high-definition video demonstration + step disassembly; case analysis microcourses select typical cases of neurology, such as "diagnosis and treatment ideas of acute cerebral infarction" and "clinical classification of multiple sclerosis." Through the model of "case presentation–problem guidance–analysis and summary," students' clinical thinking is cultivated.

3.2. Construction criteria and case screening of case bank

3.2.1. Construction standards

The construction of neurology case bank needs to meet the requirements of typicality, systematicity, and dynamics. Typicality requirements cases cover neurology common diseases, misdiagnosed diseases and intractable diseases [15], such as cerebral infarction, cerebral hemorrhage, Parkinson's disease, myasthenia gravis, multiple sclerosis, etc., and the clinical manifestations, auxiliary examinations, and diagnosis and treatment plans of cases need to be representative; systematic requirements case banks need to be classified and archived according to disease types to build a complete system of "disease typing–case information–diagnosis and treatment process–prognosis follow-up"; dynamic requirements case banks need to be updated in real time, and new cases and new diagnosis and treatment plans need to be continuously supplemented to ensure that the content of case banks keeps pace with the times.

3.2.2. Case screening and collation

The cases were mainly from the real cases clinically admitted to the Department of Neurology of our hospital, and the screening process required a three-level process of primary selection of clinicians, review by teaching teams, and review by expert committees. In the primary selection stage, the clinical teaching physician selects the cases that meet the teaching requirements; in the review stage, the teaching team checks the completeness and standardization of the cases and supplements the information of the cases such as medical history taking, physical examination, auxiliary examination, diagnostic basis, and treatment plan; in the review stage, the Neurology Expert Committee evaluates the teaching value of the cases to ensure that the cases can meet the teaching needs at different levels. The sorted cases shall be entered into the case database system in a unified format, including the modules of basic case information, medical history abstract, physical examination results, auxiliary examination data, diagnosis and differential diagnosis, treatment plan and prognosis, and the case retrieval function shall be set to facilitate teachers and students to quickly find them according to teaching needs.

4. Application path of "microclass + case database" integration model in clinical teaching of neurology

4.1. Pre-class study: Microclass guidance + case pre-analysis

On the one hand, use microcourses to carry out guidance and consolidate the theoretical basis of students. According to the teaching progress, teachers release relevant microcourse resources on the teaching platform 1 week in advance to clarify the pre-learning objectives and requirements. For example, before the teaching of "acute cerebral infarction," microlesson videos such as "Etiology and pathogenesis of cerebral infarction" and "Imaging findings of cerebral infarction" were released, requiring students to independently watch and learn and complete microlessons matching pre-study thinking questions, such as "What are the key points of imaging differentiation between cerebral infarction and cerebral hemorrhage?" "What are the indications and contraindications for intravenous thrombolysis?" Students can interact and communicate with teachers and classmates through an online platform to solve the problems encountered in the pre-study process.

On the other side, pre-analysis was performed in conjunction with cases to stimulate students' interest in learning. Teachers select at least one typical case from case bank, such as acute cerebral infarction case, only provide medical history abstract, physical examination, and auxiliary examination results, and release them to the teaching platform. Students are required to try case analysis in combination with the knowledge learned in microlectures, preliminarily determine the possible direction of diagnosis and differential diagnosis, and propose the diagnosis and treatment measures to be taken. Through pre-class case pre-analysis, students enter the classroom with problems to enhance the initiative and pertinence of learning.

4.2. Classroom teaching: Microlecture intensive lecture + case discussion

On the one hand, carry out microcourse intensive lectures and break through the heavy difficulties in clinical teaching of neurology. In classroom teaching, teachers no longer carry out comprehensive and systematic theoretical teaching, but focus on the common problems fed back by students in pre-study, combined with microclass resources for intensive lectures. For example, in view of students' unsolid mastery of the "time window for intravenous thrombolysis in cerebral infarction," teachers can play relevant microlesson videos and explain the time window requirements, dosage, and precautions of different thrombolytic drugs

in combination with actual clinical cases. For details that students tend to miss in physical examinations, students' misoperations can be corrected by playing skills microlessons and demonstrating the standardized process of neurological physical examinations on the spot.

On the other hand, carry out case study and cultivate students' clinical thinking ability. Case discussion is the core link of clinical teaching in neurology. Teachers need to select a difficult or complex case from case bank and organize students to discuss in groups to form the evaluation form of "teacher review + student mutual evaluation." During the discussion, each group of students needs to select representatives and elaborate on the diagnostic basis, differential diagnosis ideas, and treatment options of cases in combination with the theoretical knowledge learned in microlessons, while teachers play the role of guiders and comment on the shortcomings in the students' discussion, and at the same time, students outside the group comment. Through group discussion and comments with teachers and students, guide students to establish a systematic clinical thinking model and improve case analysis ability.

4.3. After-class practice: Case simulation + microclass consolidation

On the one hand, implement simulated diagnosis and treatment of clinical cases in neurology to improve students' clinical practice operation ability. After class, teachers open the case bank system to allow students to independently select cases for simulated diagnosis and treatment. Students can simulate a complete diagnosis and treatment process such as history taking, physical examination, auxiliary examination and issuance, diagnosis, and treatment planning through the case bank system. At the same time, the teaching team can organize and carry out simulated diagnosis and treatment competition, require students to complete case analysis and diagnosis and treatment plan formulation within the specified time, and score by clinicians to stimulate students' practical enthusiasm. For operational skills, such as lumbar puncture, cerebrovascular intervention simulation operation, etc., students can repeatedly watch microclass videos, combine with laboratory simulation equipment for practical training, and master operating skills.

On the other hand, microlessons consolidate and strengthen students' knowledge memory. According to the classroom teaching and case discussion, teachers sort out and summarize the heavy difficulties in clinical teaching of neurology, and make after-school review microcourses, such as "Summary of the Diagnosis and Treatment Process of Acute Cerebral Infarction" and "Key Points in the Differential Diagnosis of Common Nervous System Diseases," which are released to the teaching platform. Students can use post-school fragmentation time to watch the review microlessons and consolidate their knowledge. At the same time, teachers can set after-school practice questions in microcourses, and students can view answers and parse them in real time after completing the practice, and find out and fill in gaps in a timely manner.

4.4. Teaching evaluation: Diversified assessment + feedback improvement

On the one hand, build a diversified assessment system. Clinical teaching in neurology requires abandoning the traditional single theoretical written examination assessment model and constructing a diversified assessment system of "theoretical assessment + skill operation assessment + case analysis assessment + process evaluation." Theoretical assessment mainly examines students' mastery of neurology basic theoretical knowledge; skill operation assessment examines students' clinical skill standardization by means of simulated operation or bedside practical operation; case analysis assessment requires students to complete the analysis of an unknown case within a specified time, develop a diagnosis and treatment plan, and examine their clinical thinking ability; procedural evaluation is combined with students' pre-curricular learning,

classroom discussion participation, and post-curricular simulated diagnosis and treatment performance for comprehensive scoring.

On the other hand, carry out teaching feedback and continuous improvement. After teaching, students' feedback on the application of the "microclass + case bank" integration model in neurology clinical teaching was collected by means of questionnaires and symposium between teachers and students to understand the existing problems and shortcomings in the teaching process. Meanwhile, the assessment results of students in the control group were analyzed to assess the application effect of this integration model. According to the feedback opinions and assessment results, optimize and improve microcourses resources and case base, timely supplement the microcourses on weak knowledge points reflected by students, update the diagnosis and treatment plan in the case base in real time, and form a closed-loop teaching system of "teaching–evaluation–feedback–improvement."

5. Application effect of "microclass + case database" integration model in clinical teaching of neurology

5.1. Improving teaching quality and students' comprehensive ability

Through the application of the "microclass + case bank" integration model in neurology clinical teaching, students can independently learn theoretical knowledge using microclass resources, improve practical ability through case bank simulated diagnosis and treatment, and realize the deep integration of theory and practice. The practice results showed that the students in the observation group who used this integration model teaching had significantly higher theoretical examination results, clinical skill operation scores, and case analysis ability scores than those in the control group who used the traditional teaching model, fully demonstrating that this model can effectively improve the neurology clinical teaching quality.

5.2. Enhancing students' initiative and enthusiasm in learning

The traditional clinical teaching model in neurology is mainly taught by teachers, and students are in a position to passively accept knowledge. The integration model of "microclass + case database" guides students to actively participate in the teaching process through pre-class, classroom discussion, post-class practice, and other links. According to their own learning situation, students can independently arrange microlessons learning time and progress, through case analysis and simulated diagnosis and treatment, experience the diagnosis and treatment process of clinicians, and effectively stimulate learning interest and initiative.

5.3. Promoting the optimization and sharing of teaching resources

The construction process of the integration model of "microclass + case bank" is also the combing and optimization process of neurology clinical teaching resources. The microcourse resources developed under this model and the case database built under this model can be uploaded to the teaching platform of hospitals or colleges to realize the sharing of teaching resources, which can be used not only by interns in our hospital, but also for continuing education and training of grassroots physicians and improve the utilization rate of teaching resources.

6. Conclusion and prospects

By constructing the integration mode of "microclass + case database" and its application in clinical teaching of neurology, this paper breaks the limitation of the traditional teaching mode, realizes the organic combination of theoretical teaching and practical teaching, and provides a feasible path for clinical teaching reform of neurology. However, in the process of practice, it still needs to be further improved. First, the update speed of microcourse resources needs to be further accelerated to adapt to the rapid development of medical technology; second, the number of cases in the case database needs to be further expanded, especially the supplement of rare disease cases; third, the interaction function of the teaching platform needs to be further optimized to improve the interaction efficiency between teachers and students. In the future, with the development of artificial intelligence, virtual reality, and other technologies, it can be combined with "microclass + case bank" integration model to build an intelligent clinical teaching platform for neurology clinical teaching. Through continuous innovation and improvement, promote the continuous improvement of the quality of clinical teaching in neurology, and cultivate more high-quality clinical medical talents.

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