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Application of Electronic Pathology Reading Library in Standardized Practical Skill Training of Clinical Pathology Residents

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Abstract: *Objective:* To enhance the reading skills of clinical pathology residents, it is essential to establish a well-structured electronic pathology reading library. *Methods:* In accordance with the Resident Standardization Training Content and Standards (2022 Edition), clinical pathology residents are required to master pathological diagnoses across 11 systems: skin, head and neck, mediastinum and respiratory, digestive, urinary and male reproductive, female reproductive and breast, lymphatic and hematopoietic, bone and soft tissue, cardiovascular, central nervous, and endocrine diseases. Senior pathologists specializing in each subspecialty selected classic pathological slides, which were systematically scanned and compiled into an electronic pathology library. *Results:* A questionnaire survey was conducted to gather feedback on the electronic pathology reading library. Residents generally found it to be convenient, efficient, and conducive to learning. *Conclusion:* Training in clinical pathology diagnosis is a core component of standardized resident training. The electronic pathology reading library has been well-received and recognized by resident doctors. However, further efforts are needed to explore diverse teaching methods that align with modern educational approaches, ultimately contributing to the development of highly skilled resident doctors.

Keywords: Electronic pathology reading library; Clinical pathology; Standardized resident training; Practical skills

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1. Introduction

The standardized training program for resident physicians in clinical pathology (hereinafter referred to as "resident training") includes a comprehensive assessment of both theoretical knowledge and practical skills. Both components are equally important, with the enhancement of practical skills being a key objective of our training program [1]. Beyond strong theoretical foundations, pathologists must develop proficiency in professional skills, as they play a crucial role in bridging the gap between doctors and patients [2].

Practical skill training in clinical pathology encompasses tissue sampling and slide interpretation, with the

latter being particularly critical. Mastery of slide reading is essential for developing competent pathologists capable of handling routine pathological tasks. According to the Standardized Training Content and Standards for Resident Physicians (2022 Edition), clinical pathology residents must be proficient in diagnosing diseases across 11 systems: skin, head and neck, mediastinum and respiratory, digestive, urinary and male reproductive, female reproductive and breast, lymphatic and hematopoietic, bone and soft tissue, cardiovascular, central nervous, and endocrine diseases. Each system includes a broad range of conditions, making the learning process complex and multifaceted [3]. Some diseases, such as lymphoma, soft tissue tumors, and gynecological malignancies, are particularly challenging and require extensive, repetitive slide reading practice for mastery [4]. Therefore, the establishment of an electronic pathology slide reading library significantly enhances subspecialty training and facilitates skill development among residents.

2. Materials and methods

2.1. Data collection

In accordance with the Standardized Training Content and Standards for Resident Physicians 2022 Edition syllabus, pathological slides from the Pathology Department of Baoding First Central Hospital, collected from October 2013 to the present, were screened. Slides representing diseases from the 11 systems that clinical pathology resident physicians are required to master were selected for data preparation.

2.2. Methods

2.2.1. Process for establishing an electronic slide reading library

Folders were created for the 11 systems specified in the syllabus (**Figure 1**), with subfolders designated for different diseases within each system (**Figure 2**). Conventional slides were then borrowed from our professional base, categorized by system. Two senior pathologists from the relevant sub-specialties reviewed and selected classic cases. The Jiangfeng slide scanner was used to scan and archive these classic slides (HE + IHC). The scanned electronic slides allow free dragging, zooming in, and zooming out (**Figures 3** and **4**). Additionally, electronic medical history information was incorporated to ensure data completeness. The establishment of an electronic slide reading library enables resident physicians to systematically review disease diagnoses in alignment with the syllabus, providing a clear and structured learning objective.

Figure 1. Classification by system

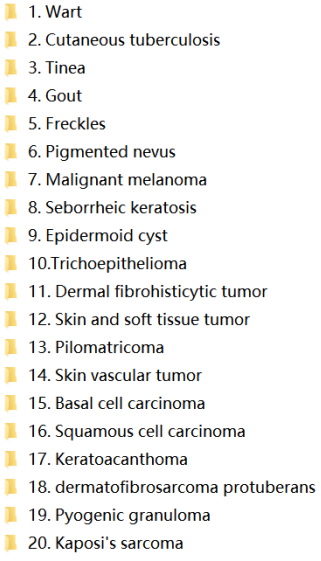

Figure 2. Classification by disease name

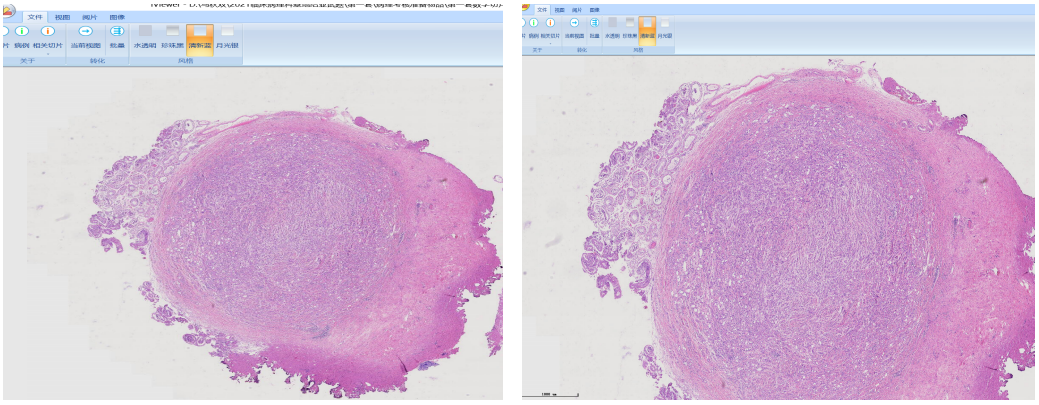

Figure 3. Low magnification of electronic pathological section: Observing the general outline

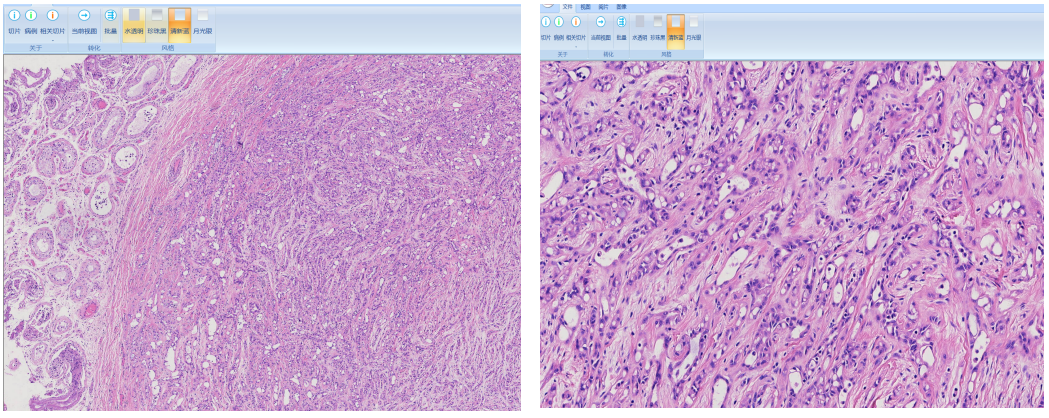

Figure 4. High magnification of electronic pathological section: Observing cell structure

2.2.2. Usage method of the electronic pathology slide reading library

Pathology is a highly specialized field characterized by complex classifications, abstract concepts, and extensive content that requires memorization and comprehension. Diagnostic criteria are intricate, demanding experience in slide interpretation. The establishment of an electronic slide reading library significantly enhances the learning experience of resident physicians and improves the process management of pathology training programs.

Convenience for real-time learning of resident physicians: With the aid of scanning software, resident physicians can repeatedly examine slides and refine their diagnostic skills, ensuring high operability. Simultaneously, instructors can provide real-time guidance, eliminating the need for borrowing and returning glass slides, thereby saving time. Furthermore, electronic images from the slide reading library can be easily captured for research papers and professional presentations (PPTs), avoiding the inefficiencies and quality issues associated with using mobile phone photography.

Application to process management in clinical pathology training: In the management of clinical pathology residency training programs, resident physicians must undergo monthly, annual, and final assessments, covering both theoretical knowledge and practical skills. The latter includes sample collection and slide reading evaluations. The electronic pathology slide reading library can be integrated into these assessments (see **Figures 5** and **6** for details), offering a faster, more convenient, safer, and reusable alternative to traditional glass slide preparation. This method closely replicates residency skill assessment procedures, enabling resident physicians to develop proficiency in slide interpretation and respond more efficiently during exams. For an example focusing on the female reproductive system, refer to **Figure 7**.

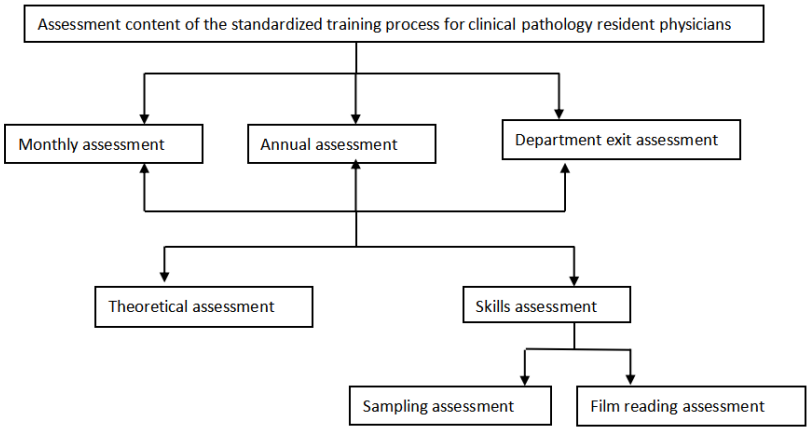

Figure 5. Standardized training and assessment content for clinical pathology resident physicians

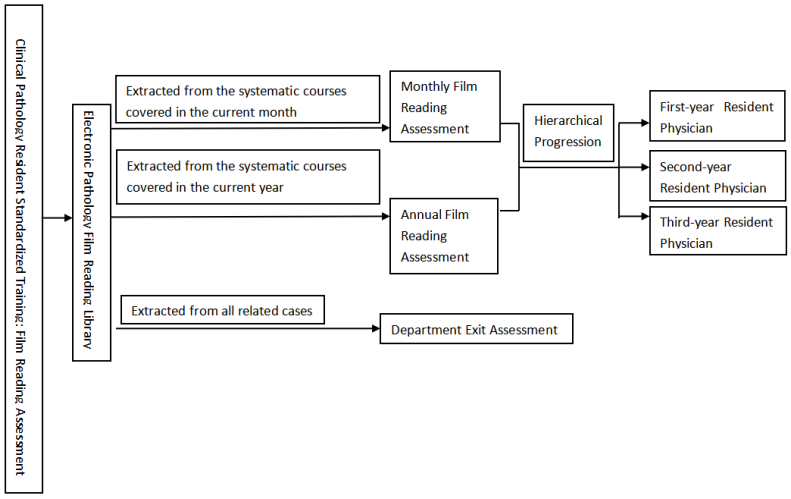

Figure 6. Use of the electronic pathology slide reading library in standardized training skills assessment for resident physicians

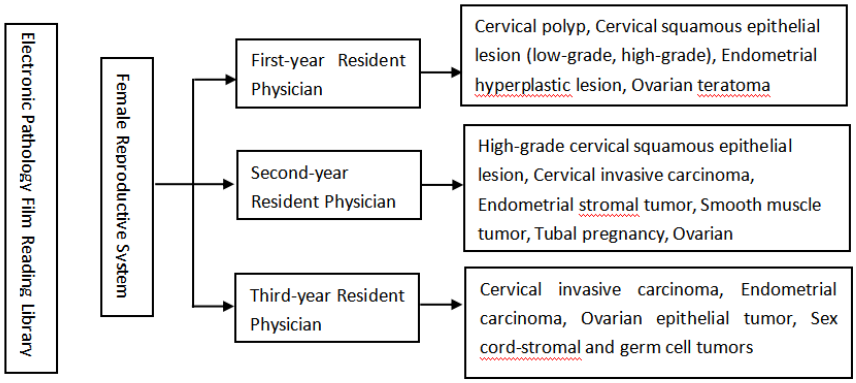

Figure 7. Demonstration of the use of electronic slide library using the female reproductive system as an example

3. Results

A feedback survey was conducted using the Wenjuanxing survey tool to assess resident physicians' use of the electronic pathology slide reading library. Overall, residents found the library to be convenient, efficient, and beneficial for learning (**Figures 8** to **10**). However, feedback from instructors at our training base revealed that some trainees prioritized speed over careful observation when reading electronic slides, leading to discrepancies compared to conventional pathology slide reading. Therefore, exclusive reliance on the electronic slide reading library is insufficient. It should be integrated with conventional pathology slide reading to develop pathologists with strong diagnostic skills.

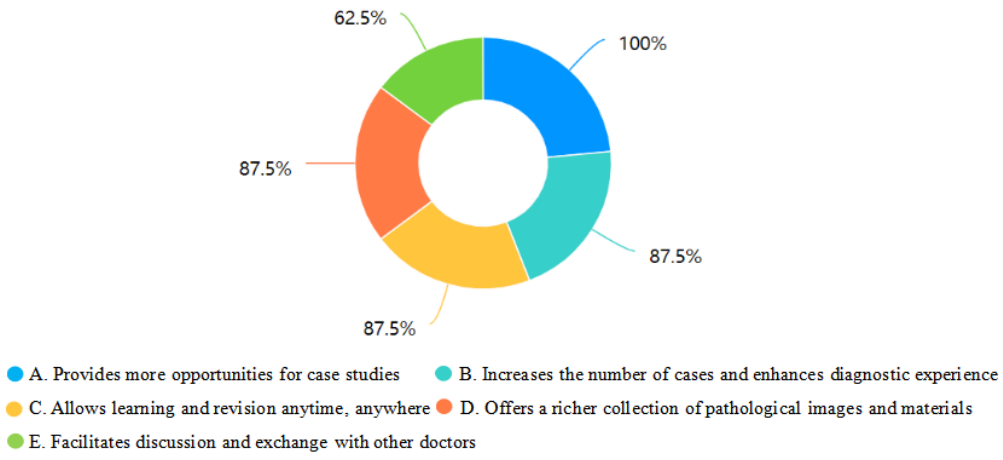

Figure 8. Advantages of using electronic pathology slide reading library

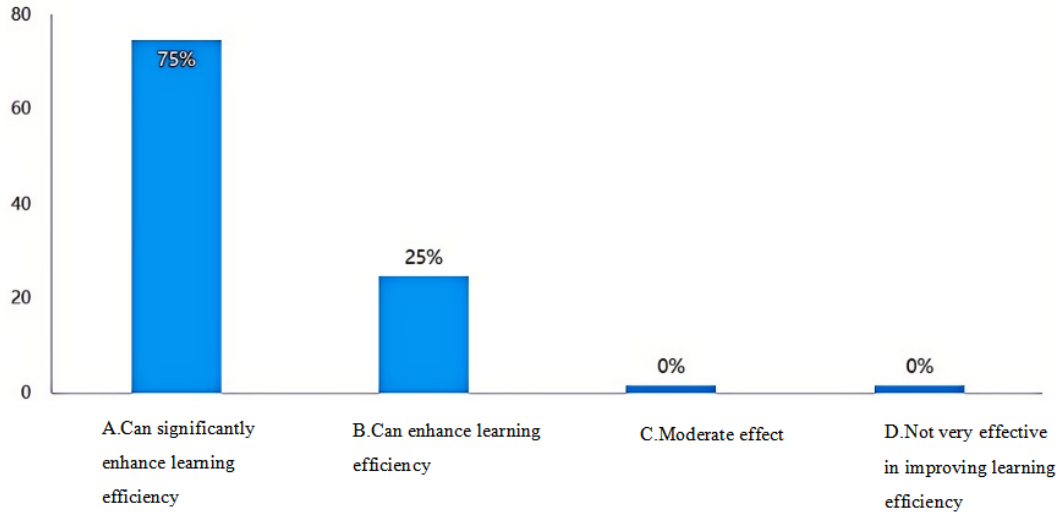

Figure 9. Learning efficiency after using electronic pathology slide reading library

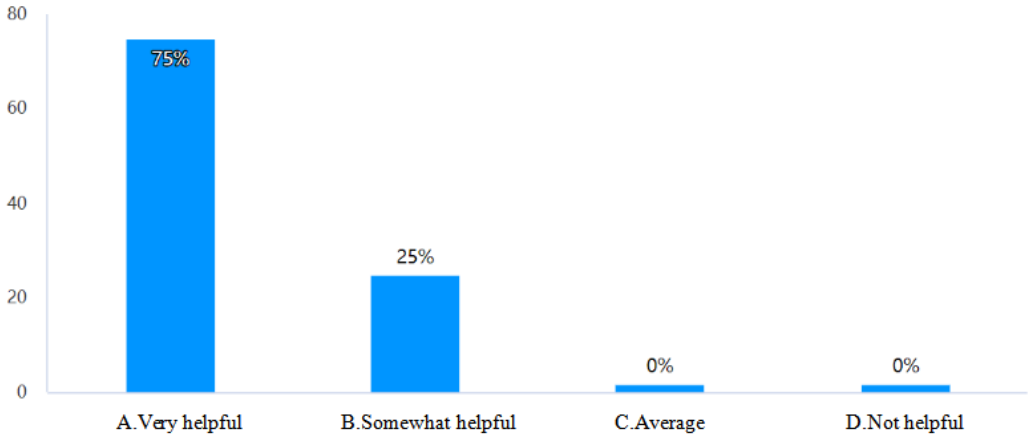

Figure 10. Feedback on the usage of electronic pathology slide reading library

4. Discussion and conclusion

Resident physician standardized training is a vital component of continuing medical education, playing a significant role in cultivating high-level medical professionals and improving healthcare quality [5]. Clinical pathology serves as a scientific foundation for diagnosing and treating human diseases and is a key discipline for studying disease occurrence, progression, and prognosis [6]. Additionally, clinical pathology provides essential advisory services within clinical applications, offering explanations and recommendations for further examinations and treatments, which hold considerable clinical significance. Therefore, ensuring high-quality and sustainable clinical pathology training is crucial for enhancing medical standards [7].

During their training, resident physicians in this specialty are typically responsible for conducting preliminary pathological diagnoses. However, slides used in routine departmental work must be promptly archived to allow patients to borrow them for consultations. This necessitates that resident physicians borrow slides from the pathology archive. Traditional glass pathology slides, while widely used, are fragile and susceptible to damage or loss if not properly stored. Furthermore, borrowing patient slides for repeated observation and learning poses certain risks. To address this, our training base previously established a library of glass pathology slides for teaching purposes. After obtaining informed consent from patients and their families, slides were prepared and categorized by disease system. However, this method still carries risks of damage and loss. When certain slide categories become unavailable, preparing new slides is both time-consuming and labor-intensive. Consequently, integrating an electronic pathology slide reading library into the training program is essential.

The standardized training of clinical pathology residents differs from other clinical specialties due to its unique characteristics, the complexity of diseases, diverse content, and varying diagnostic criteria. It requires a strong foundation in fundamental knowledge, with training content designed and implemented according to professional requirements [8,9]. To cultivate competent and skilled pathologists, clinical pathology diagnosis training serves as the core of the entire standardized training process. The introduction of an electronic pathology slide reading library has been well-received by resident physicians. With the rapid advancement of online platforms and the increasing accessibility of updated medical information, modern learning through multiple channels and methods has become a prevailing trend. Resident training administrators must continuously explore innovative strategies and models to enhance standardized training and improve physicians' professional competencies. The journey toward advancing resident training remains challenging and requires a concerted effort from the training base. By leveraging

institutional strengths and adopting teaching models aligned with modern educational approaches, we can strive to cultivate outstanding resident physicians.

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Disclosure statement

The authors declare no conflict of interest.

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