Transitioning to a new era of digital pathology

Focus on Gifu University Hospital, Japan

Addressing challenges in traditional pathology practices

Due to the rural and mountainous landscape in Gifu prefecture, hospitals in the region face several challenges in their traditional pathology workflow.

Pathologists' workload

In Japan, many hospitals employ only one full-time pathologist, which leads to burnout and difficulty taking time off due to staffing constraints

Limited collaboration

Consultations with local and international experts are challenging due to distance, especially in rural regions

These challenges highlight the need for a **transition to digital pathology**, which offers a better path towards effective diagnosis and treatment for patients. **Gifu University Hospital**, a prominent medical institution in Gifu prefecture, implemented digital pathology solutions to support medical standards and improve patient care in **Chuno Kosei Hospital** and **Inuyama Chuo General Hospital**, with plans to extend support across the region.

Join us as we delve into the capabilities, challenges, and endless potential of the digital pathology revolution.

Tatsuhiko Miyazaki
Professor,
Department of Pathology,
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We sat down with Prof. Tatsuhiko Miyazaki, a renowned expert in the field of pathology at Gifu University Hospital in Japan, to learn about the benefits, considerations, and prospects for digital pathology.

Q1: What are the benefits of implementing digital pathology in your institution?

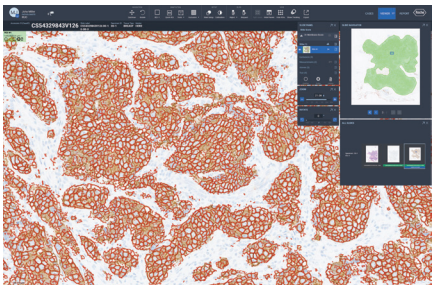
A: The main advantage of implementing digital pathology is the **ability to perform real-time consultations remotely**. Pathologists can share images digitally when they encounter a challenging diagnosis and receive remote consultation without being on-site or in their office. The diagnosis can then be confirmed with microscopic examination of the physical samples. This is especially relevant in Japan, as most hospitals have only one full-time pathologist. Additionally, in rural areas like Gifu prefecture, hospitals often do not employ full-time pathologists. Pathologists need to **travel over 120 km to perform intraoperative rapid diagnosis on-site**, which is physically challenging. **Conducting remote intraoperative rapid diagnosis using WSI offers an effective solution**, making it easy to seek a second opinion. The images are also archived, allowing for reuse as educational resources.

Q2: What are the considerations when performing intraoperative rapid diagnosis?

A: When remote intraoperative diagnosis is performed, the pathologist **relies entirely on the on-site clinical laboratory technician for sample preparation**, as the pathologist cannot observe macroscopic details or specify areas of interest on the sample preparation surface remotely. Artifacts are often observed, depending on the skill of the technician preparing the sample. The prepared sample may not accurately represent the true nature of the lesion, especially when clinicians trim and submit small samples. Therefore, it is essential to pay close attention to sample orientation and artifacts when making remote diagnoses.

Q3: How does the quality of the images from pathological WSI using the Ventana DP200 compare with those from microscopic sample slides?

A: The quality of pathological WSI from the Ventana DP 200 is comparable to H&E-stained microscopic slides. In particular, the **color reproducibility is significantly superior** compared with other products that use single CCD sensors with Bayer array 3 primary color filters. Moreover, **the scanner's exceptional resolution enables high-quality scans of fine details at 20x magnification**, surpassing the capabilities of a traditional microscope. Even at 40x magnification, cilia and microvilli on the cell membrane can be clearly observed with H&E staining. We attribute this excellent image quality to the adoption of a line sensor using prism 3 primary color spectrometry.



Q4: How do you find the operability and image viewing experience of the Roche digital pathology solution?

A: The Roche digital pathology solution offers excellent operability, including **magnification and adjustment of the field of view**. A map of the entire sample is displayed on the screen, which allows the operator to make **extensive movements across the sample and offers better usability than a traditional microscope**. The map display also maintains orientation even when observing fine details at high magnification. Further, **the ability to make on-screen annotations is highly convenient**, especially while reviewing the slides.

Q5: What were the challenges faced during the implementation of digital pathology for remote intraoperative rapid diagnoses?

A: One challenge faced during the collaboration between Chuno Kosei Hospital and Gifu University Hospital was the differing security requirements for image sharing. **This issue was resolved by Roche, who led negotiations and developed the necessary network infrastructure to meet these requirements**. We are confident that Roche, with its technological and negotiation capabilities, can resolve similar issues that are expected to arise in other hospitals that are undergoing network infrastructure development.

Q6: What are your expectations for digital pathology in the future?

A: We anticipate significant developments in AI for the analysis of digitized pathological tissue images. This will enhance efficiency and quality control, and address the shortage of pathologists, a challenge faced across Japan. WSI systems, including digital pathology, will play a crucial role in this context. We have high expectations that the algorithms currently in development, such as those for gastric cancer diagnosis, will alleviate pathologists' workload. We also hope that physicians can access digital pathological tissue images via a single sign-on from the EMR, providing deeper insights into the pathological findings.

We hope that all manufacturers of WSI scanners will comply with the standard DICOM format when sharing tissue images digitally, which will significantly enhance operational efficiency, compared with the use of different software with varying levels of operability.

Q7: What are your plans for intraoperative rapid remote diagnoses in your institution and within Gifu prefecture?

A: Within this fiscal year, we aim to start intraoperative rapid remote diagnosis within the hospital networks in Gifu prefecture. In preparation for the opening of a large-scale hospital in 2 years, we plan to establish a new network for remote intraoperative rapid diagnosis and consultation. Over the next few years, we will develop similar networks with approximately five other hospitals, thereby **establishing a comprehensive pathology diagnosis support system within the prefecture**. Digital pathology solutions, such as WSI and information sharing systems, will play a central role in these plans. We expect to partner with Roche to **develop an integrated network at Gifu University Hospital**, which can efficiently switch connections without the need to increase the number of terminals, all while securely connecting multiple hospitals via dedicated lines for image sharing.

We also aim to standardize WSI viewer and staining equipment within Gifu University Hospital and across other hospitals in the network to enhance efficiency and standardization during the diagnosis process in Gifu prefecture.

"We expect to partner with Roche to develop an integrated network at Gifu University Hospital"

Collaboration between hospitals enhances operational efficiency

Gifu University Hospital utilizes digital pathology to provide medical support to Chuno Kosei Hospital and Inuyama Chuo General Hospital:

Remote intraoperative rapid diagnoses:
60 cases/year

Remote consultations:
5 cases/year

With the establishment of the **Gifu Pathological Diagnosis Digital Network**, Gifu University Hospital will provide valuable medical support to additional hospitals and support larger volumes of remote cases in the future.

Digital pathology alleviates workload and improves patient outcomes

Reduced workload burden for pathologists

Remote consultations with digital pathology allow pathologists to take time off, including vacations, medical leave, maternity leave, and business trips. This helps **minimize burnout** and **address manpower shortages**.

Better quality of life for patients

Establishing a digital pathology network between hospitals enables more widespread use of frozen sections, improving **diagnoses** and **treatment options**, which ultimately enhances patients' quality-of-life.

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Abbreviations:

AI, artificial intelligence; CCD, charge-coupled device; DICOM, Digital Imaging and Communications in Medicine; EMR, electronic medical record; H&E, hematoxylin and eosin; WSI, whole slide imaging.