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ORIGINAL ARTICLE

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Impact of the adjunction of a short video to an original article for the recognition of newly described tumor entities in pathology: An interventional prospective study

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Abstract

Context: Merkel cell carcinoma diagnosis is often based on microscopic examination by pathologists. While histopathologic diagnosis primarily hinges on conscious and analytical cognition, the pathologist's decision-making process is also influenced by a rapid "gist" or "gestalt" approach. In this study, using cases of Merkel cell carcinoma as a model, we aim to assess how pathologists' viewing short videos containing conceptual clues and visual aids, in conjunction with reading an original article as a reference, may enhance their diagnostic performance.

Method: Sixteen pathologists were included in the present work. After participants had read the original article, their ability to distinguish Merkel cell polyomavirus (MCPyV)+ and MCPyV− Merkel cell carcinoma cases was evaluated on a first preliminary series of 20 cases. Following this test, the participants watched the video and then evaluated a second "experimental" series of 20 independent cases.

Results: After reading the original article, for each case, a median number of 12 participants (75%, Q1–Q3: 10–13) classified the specimen in the correct category (92 incorrect answers in the whole series). An important interobserver variability was observed in this setting (Kappa coefficient = 0.465). By contrast, following the video, all cases were correctly classified by most of the participants, with only 12 incorrect answers on the whole series and excellent interobserver reproducibility (Kappa coefficient = 0.846).

Conclusion: Our study demonstrated that providing a short video together with an original article may enhance pathologists' performance in diagnosing Merkel cell carcinoma.

KEYWORDS
clinical education, dermatology, pathology education, resident tool

Antoine Taillandier and François Avry contributed equally to this study.

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1 | INTRODUCTION

Merkel cell carcinoma (MCC) stands as an aggressive neuroendocrine skin carcinoma, exhibiting a 40% 5-year overall survival rate.[1] In 2008, Feng et al. discovered the Merkel cell polyomavirus (MCPyV) integrated into the genome of MCC cells, establishing it as a key factor in about 80% of cases.[2] The remaining 20% of MCC cases, lacking MCPyV integration, are distinct and primarily induced by ultraviolet radiation. Pathologists can leverage significant morphological disparities between these subsets for the diagnosis and characterization of MCC.[3] Similar to other medical specialties involving image interpretation, a pathologist's diagnosis encompasses a complex interplay of perceptual and cognitive processes,[4] many of which remain poorly understood.[5,6] While decision trees dominate the conscious aspect of diagnosis,[7] rapid "gist" processes, sometimes referred to as "wallpaper matching," are employed by experienced practitioners.[4,8]

Several studies demonstrated, by eye-tracking experiments, that expert pathologists directly focus on pathological areas[8] and are further able to classify a tissue section as normal or pathologic in a few milliseconds, even before conscious identification of the lesion.[9] This suggests that the basic "gist"/"gestalt"[10] of medical images occur very early in this population. These findings are in line with the view that unconscious mechanisms based on personal experience significantly contribute to the interpretive process.[9] Accordingly, an assessment of pathologists' learning styles reveals that, in contrast to residents and young pathologists who focus on conceptual clues ("learning by thinking"), experienced practitioners prefer learning "by experience" through the repetition of case observations.[11]

In this context, considering the low MCC incidence rate,[12] a critical concern in the training of both resident and active practitioners revolves around fostering two essential aspects: the development of conscious cognitive processes based on conceptualization and instinctive "gist" abilities.[13] However, most of the advances in pathology, such as the description of new tumor entities, are typically reported in an original article format, often with limited illustrations, potentially favoring the acquisition of conceptual concepts over hands-on and visual experience.

Over the last decade, major changes occurred in medical teaching, notably driven by the introduction of new technologies[14] and shifts in the pathologist's mindset. The younger generation favors pathology learning through digitalized and interactive education tools.[15] Accordingly, concise case presentations and short videos,[16] sometimes available on social media platforms, are now recognized as effective tools for teaching in the evolving landscape.[17]

Thus, our working hypothesis was that short videos including conceptual clues, but also numerous illustrations might enhance both conceptual understanding and experience abilities.

Therefore, the aim of the present study was to assess how effectively short videos, when used alongside an original article, could support pathologists to distinguish MCPyV+ and MCPyV− entities using an original article alone as a reference.

2 | METHOD

2.1 | Participants

For this interventional prospective study, practicing pathologists and residents from three pathology departments and from one private office were asked to participate in the present study between July 15, 2022 and September 10, 2022. Age, sex, position (resident, fellow, senior pathologist), practice (hospital or private), and self-reported experience of the pathologists in the investigated field were recorded for all participants.

2.2 | Educational resources

Morphological MCPyV+ and MCPyV− MCC distinction is not yet used in current practice. Thus, pathologists are not trained to make the distinction between these two tumor types. Therefore, a 240-s-duration video (Video S1), including a detailed presentation of the diagnostic criteria followed by 40 representative illustrations of MCPyV+ and negative MCPyV− samples, was produced by one author (T.K.). Our recently published original article was used as the gold standard teaching material of the study.[3]

2.3 | Cases selection and MCPyV status determination

MCC tumor samples used in the video, preliminary and validation series were selected from a prospective cohort of MCC patients from 10 French hospital centers and tumors were collected between March 1998 and October 2020. MCPyV status was determined using quantitative PCR and immunohistochemistry (Ab3 clone), as previously reported.[18]

2.4 | Study design

The intervention was conducted through an online survey platform (https://www.survio.com/fr/). After participants had read the original article, their ability to determine MCPyV status was evaluated on a first preliminary series of 20 cases (10 MCPyV+ and 10 MCPyV− cases, 1 picture/specimen). Participants were asked to provide their diagnosis (MCPyV− or MCPyV+) as well as their level of confidence ranging from 0 ("I don't know") to 4 ("I am sure"). Following this test, the participants watched the video and then evaluated a second "experimental" series of 20 cases following the same modalities as previously described. The characteristics of the participants were requested at the end of the test.

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2.5 | Statistical analysis

Continuous data were described with median (Q1–Q3) and categorical data with number (%) of interpretable cases. Continuous data were compared by the Mann–Whitney test. Categorical data were compared by a two-tailed Fisher's exact test. Interobserver variability was determined using the Kappa test of Fleiss due to a number of raters higher than two and Kendall's coefficient of concordance. Statistical analysis involved the use of XL-Stat-Life (Addinsoft, Paris, France).

3 | RESULTS

3.1 | Participant's characteristics

Sixteen participants were included in the present study (Figure 1). Nine were women (56%) and seven were men (44%). The median age was 38 years (Q1–Q3: 29–56). Among them, 5 were residents (31%), 11 were working as senior pathologists in a university hospital (66%), including 3 professors and 2 assistant professors, and 1 had a private practice (Figure 1). Based on their own opinion, eight participants declared to have only basic knowledge regarding the topic investigated, that is, MCC, while only one participant had significant experience in this field.

3.2 | Modest diagnostic performances are observed after training with an original article as a unique educational modality

After reading the original article, most of the participants accurately classified the majority of cases ($n = 17/20$) as either MCPyV+ or MCPyV− (Figure 2). However, an important interobserver variability was observed in this setting with a Kappa coefficient of 0.465 (Kendall's coefficient of concordance = 0.463). Indeed, for each case, a median number of 12 participants (75%, Q1–Q3: 10–13) classified the specimen in the correct category (92 (29%) incorrect answers in the whole series). No statistically significant difference was observed between the performances of seniors and residents, although a trend toward higher variability was detected in this latter group, as shown in Figure 3.

3.3 | Adjunction of a short video to the original article allows to a better discrimination of the two tumor entities

Following the video, all cases were correctly classified by the majority of the participants (Figure 2), with only 12 (4%) incorrect answers on the whole series (median number of participants classifying the

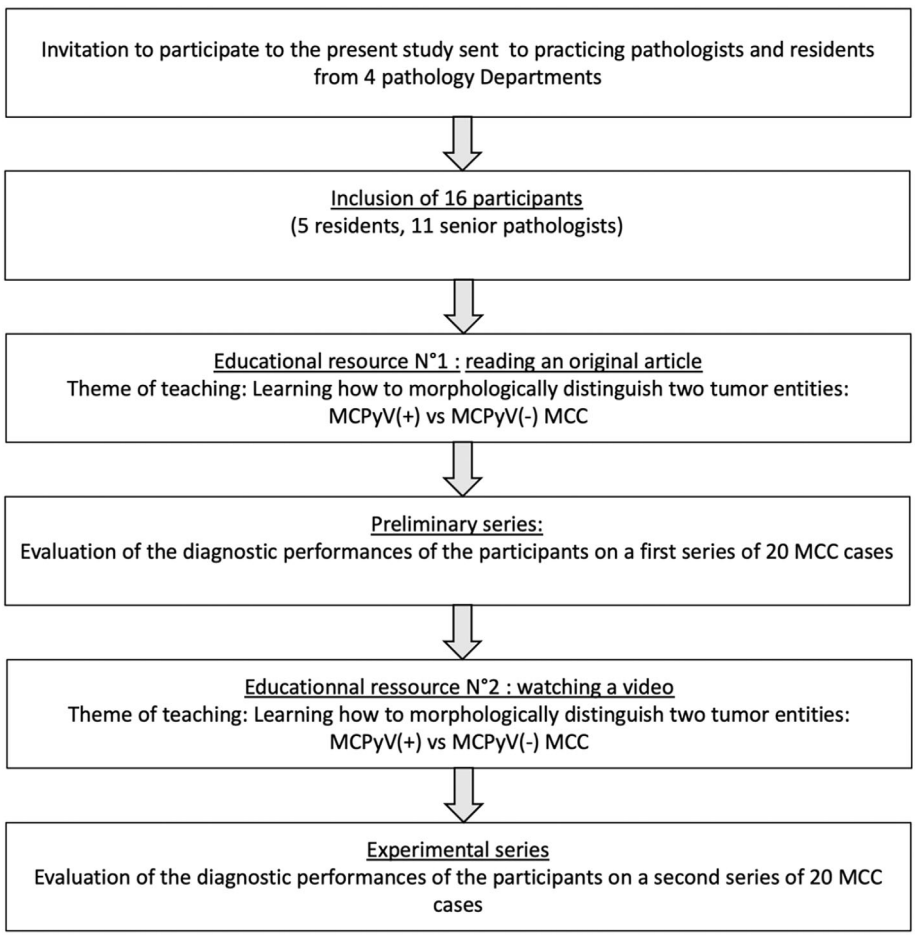

FIGURE 1 Flow chart.

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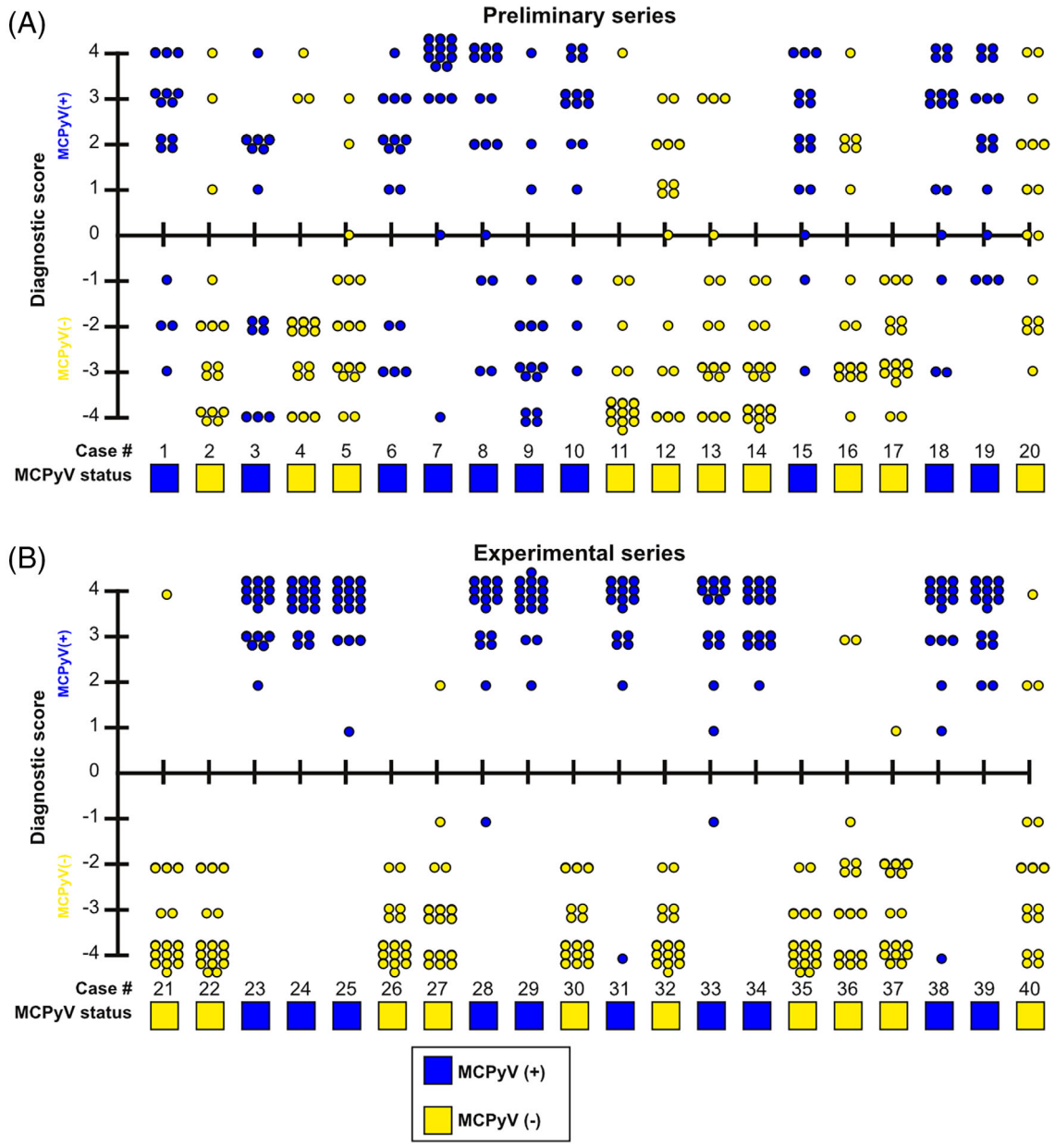

FIGURE 2 Determination of the MCPyV status by all participants on the preliminary (A) and experimental (B) cohorts using a semiquantitative score.

specimen in the wrong categories = 0, Q1–Q3: 0–1) (Figure 4), such number of misdiagnosed cases being significantly lower than in the initial series ($n = 92$, $p < 0.001$). Moreover, excellent interobserver reproducibility was observed in this setting with a Kappa coefficient of 0.846 (Kendall's coefficient of concordance of 0.854).

4 | DISCUSSION

The results of our study shed light on the educational effectiveness of viewing a short video in training pathologists to diagnose MCC subtypes based on Merkel cell polyomavirus integration. To our knowledge, most significant advances in pathology are typically presented in the form of original articles, but the suitability of this knowledge transfer method for this specific context has not been previously explored. We observed that after participants read the original article, MCPyV+ or MCPyV− diagnostic performance was modest, indicating the diagnosis of MCC subtypes is not always straightforward.

Interestingly, the addition of short videos alongside the original article significantly improved the participants' ability to discriminate between the two tumor entities. The excellent interobserver reproducibility observed with the videos further underscores their effectiveness in standardizing interpretations. Therefore, our results suggest that an adjunction of short videos to an original article might contribute to the formation of resident and senior pathologists in current practice.

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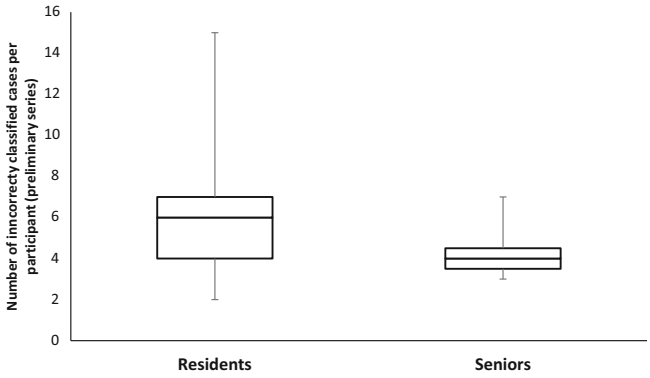

FIGURE 3 Diagnostic performances of the residents and senior pathologists for MCPyV status determination in the preliminary series. The results are expressed in a number of cases incorrectly classified. Ranges, quartiles, and medians are shown.

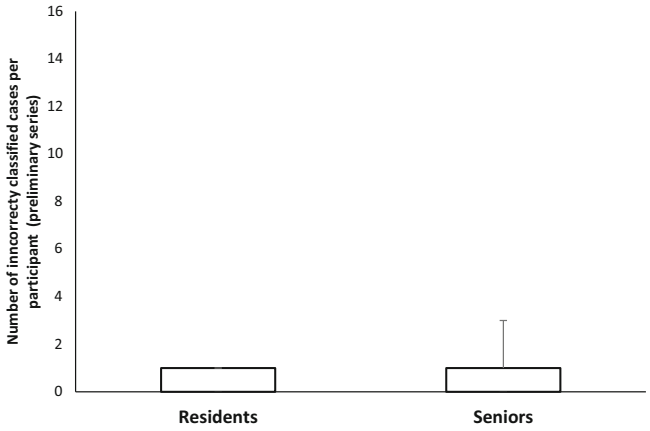

FIGURE 4 Diagnostic performances of the residents and senior pathologists for MCPyV status determination in the experimental series. The results are expressed in a number of cases incorrectly classified. Ranges, quartiles, and medians are shown.

These results align with the broader trend in medical education, where digital and interactive tools are gaining prominence and effectiveness,[19] especially among younger practitioners. Notably, initial training in medicine now includes multimodal and self-directed ways of learning.[19] For medical students and active practitioners, learning styles have been demonstrated to differ among the medical specialties[20,21] and from resident to senior[22] suggesting that pedagogic techniques should be adapted to a precise setting. As an example, in medical specialties based on image recognition, such as radiology, dermatology, and pathology, a shift from cognitive conceptualization/analytic approach (learning by thinking) to experience (holistic image recognition) seems to be observed during the training.[4,8]

In addition to the changes observed in medical education, technological advances also largely contribute to the evolution of pathology through the development of next-generation sequencing. Indeed, massive molecular characterization of tumor samples leads to the identification of recurrent genetic alterations in almost all fields of pathology and helps to define new tumor entities.[23] Importantly, such recurrent oncogenic drivers (such as translocation and virus integration) are frequently observed in rare tumor types. The latter frequently harbors a stereotypic morphology therefore being identifiable under the microscope.[24] Although the conceptual association between a genetic alteration and a tumor entity is easy to assimilate after reading an original article, it is unclear whether the provided illustrations are sufficient to train pathologist perception and allow tumor recognition by the reader. We assume that both iterative exposure to images and a plurality of tools used may be helpful in improving recognition. Moreover, since the constitution of a large series of rare tumors is frequently required for original papers, this later setting constitutes a perfect opportunity to compile the cases and generate short videos for pathologists' training.

Another major advance is the development of artificial intelligence and deep learning, which will likely become integrated into pathologists' decision-making practice in the coming years.[25] Development of such tools is based on the analysis of many specimens of a given tumor entity, permitting the computer to learn through an iterative process that remains poorly understood ("black box concept"). Several findings seem to indicate that learning "by experience" through the repetition of case observations is also deeply involved in the decision-making of experienced pathologists. First, evaluation of learning methods revealed a preference for watching and experimenting in this population.[25] Second, expert pathologists make part of their diagnostic decision (e.g., binary classification as normal or pathologic) within the first few milliseconds, before any conscious conceptualization has occurred, suggesting that pedagogic tools in pathology might address conceptual clues but also train diagnostic skills of the learner. In this context, further studies are required to precisely determine which pedagogic tools based on experience are able to develop such a pathologist's skills.

The high number of illustrations included in our video is likely to have contributed to the improved diagnostic performances of the participants in the second series; however, the lack of formal demonstration that these findings were due to these pictures and not to the conceptual clues provided in the introductive part is obviously a limitation of the present study. Another limitation of the current study is obviously the lack of randomization of the participants in two groups to compare the impact of the original article versus video, however it should be noted that our goal was to demonstrate the relevance of the adjunction of a video to an original article whether than compare the performances of these two pedagogic modalities.

The variability in diagnostic performance observed in our study, particularly among residents, highlights the need for continued efforts in refining educational strategies for pathologists. It raises questions about the optimal balance between conceptual understanding and practical experience in training programs. Future research may delve deeper into the specific aspects of short videos that contribute to their effectiveness and explore how they can be integrated into pathology education more broadly. Ultimately, our study suggests that incorporating multimedia resources, such as short videos, into the

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learning process can be a valuable tool for improving diagnostic accuracy in the field of pathology.

To conclude, our results suggest that adjunction of short videos to an original article contribute to knowledge transfer and to the improve pathologist diagnostic skills.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

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