

E4 Detection of Urothelial Carcinoma in Upper Urinary Tract Cytology using a Digital Artificial Intelligence-Assisted Tool

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= Abstract =

Introduction: The clinical management of upper tract urothelial carcinoma (UTUC) heavily depends on upper urinary tract (UUT) cytology, which can potentially lead to major surgery. Until now, the detection of suspicious UUT lesions using cytology was a difficult task. We examined an artificial intelligence (AI)-empowered digital cytology tool for improving the accuracy of UUT cytology. This tool detects atypical urothelial cells (AUCs) in whole-slide images (WSIs) and displays them in a visual gallery for rapid assessment, thus simplifying interpretation. **Materials and Methods:** In this retrospective study, we gathered 100 paired Cytospin and SurePath slides from 50 patients and created digital WSIs. An AI algorithm analyzed each WSI, identified the 24 most suspicious/atypical cells and presented these in thumbnail gallery for the cytologists' review (Fig. 1). Three senior cytologists (with variable experience using the AI-assisted tool: A- over 12 months; B- 6-12 months; and C- less than a month) used the AI tool to assess WSI cell galleries and make a final interpretation using The Paris System categories. We evaluated the efficacy and time-saving aspects of the AI-assistance method for UUT cytology interpretation. **Results:** There was no difference in the diagnostic performance of cytologists between the two preparations (Table 1). A positive correlation was noted between performance and the level of experience with the use of the AI tool. Cytologists A and B, with more experience using the AI tool, demonstrated remarkable efficiency (84.0-96.0% sensitivity, 92.0-96.0% specificity, 91.3-95.7% PPV, 85.2-95.8% NPV, and 88.0-94.0% accuracy), while cytologist C, who had the least experience, displayed poorer performance. Cytologist C spent less time in reviewing slides (median 29.5-30.0 seconds), compared to the other cytologists (median 63.5-71.5 seconds) (Fig. 2). Although cytologist C spent less time on negative slides (median 20-25 seconds), time spent on positive slides was consistent among all cytologists (median 57-100 seconds) (Fig. 3). **Conclusions:** The AI-assistance tool

showed outstanding efficiency for the interpretation of UTT cytology. Cytologists' experience utilizing the AI tool influenced interobserver variation in both diagnostic performance and review time, emphasizing the significance of being acquainted with the technology.

Figures and Tables:

Fig. 1. The viewing software's display of atypical urothelial cell images in an image gallery (A) and the whole-slide image (B)

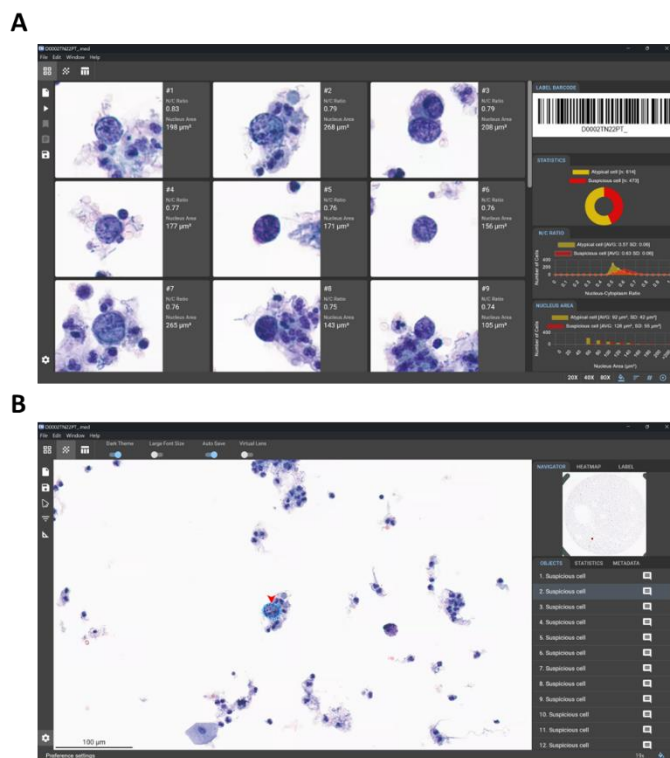


Table 1. Performance of the AI-assisted approach in diagnosing upper urinary tract cytology

Cytoreparation	Cytospin (N = 50)				SurePath (N = 50)			
	Gold Standard	Cytologist A	Cytologist B	Cytologist C	Gold Standard	Cytologist A	Cytologist B	Cytologist C
# Positive	25	23	23	13	25	26	23	10
# Negative	25	27	27	37	25	24	26	40
Sensitivity		88.0%	84.0%	52.0%		96.0%	87.5%	40.0%
Specificity		96.0%	92.0%	100.0%		92.0%	92.0%	100.0%
PPV		95.7%	91.3%	100.0%		92.3%	91.3%	100.0%
NPV		88.9%	85.2%	67.6%		95.8%	88.5%	62.5%
Accuracy		92.0%	88.0%	76.0%		94.0%	89.8%	70.0%

PPV = positive predictive value; NPV = negative predictive value

Fig. 2. The box plot depicts the duration of examination per cytologist for each slide and the median review time for each slide

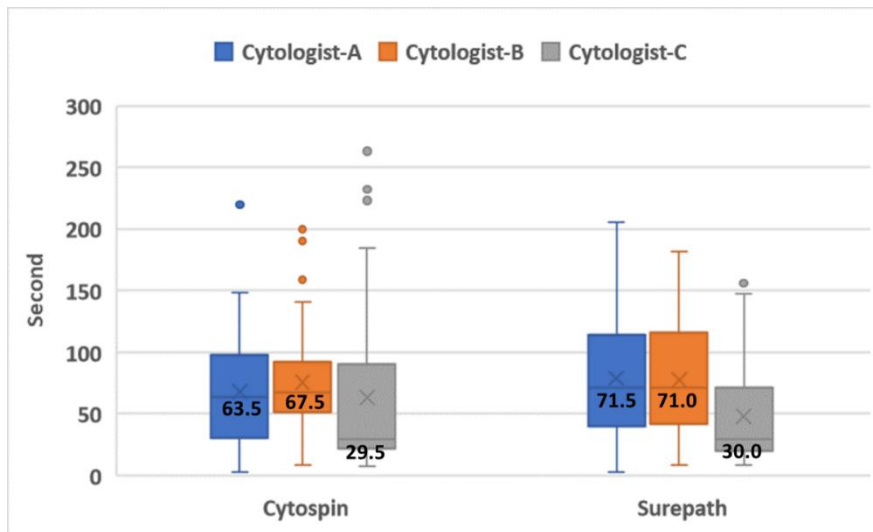
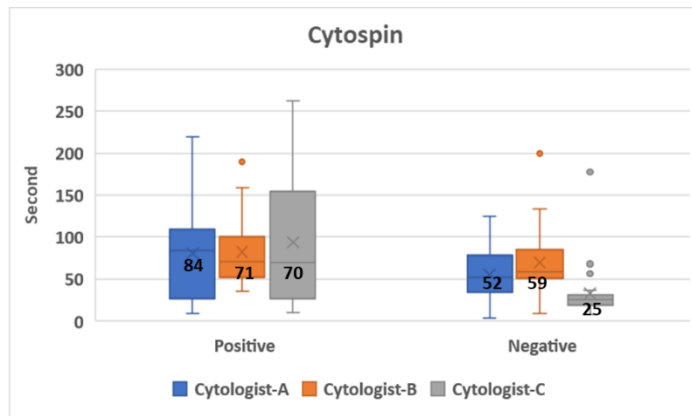


Fig. 3. The box plot depicts the duration of examination for disease positive/negative slides per cytologist and the median review time for each positive/negative slide

A



B

