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Clinical Impact of AI - Augmented Lymph Node Evaluation in Metastatic Gastric, Colorectal and Breast Cancer

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Abstract
Examination of lymph nodes (LN) plays a critical role in cancer staging and prognosis, however, it remains a time-consuming and labor-intensive process in pathology. While artificial intelligence (AI) tools have shown promise in improving diagnostic accuracy, their real-world clinical utility in LN metastasis detection across multiple cancer types remains underexplored.

Objective
To evaluate the diagnostic performance and efficiency of an AI module in detecting LN metastases from gastric, colorectal, and breast cancers, and to assess its impact on pathologists' workflow.

Design
A retrospective study was conducted using 314 whole-slide images from 95 patients who underwent resection for gastric, colorectal, or breast cancer. Three board-certified pathologists reviewed the slides with and without AI assistance. Diagnostic accuracy, review time, and number of mouse clicks required to detect metastases were recorded and compared.

Results
AI assistance increased sensitivity from 91.8-3.9% to 95.9% for all pathologists, while specificity remained high (97.0-98.9%). Time to detect LN metastases reduced by up to 78% for some cancer types. The AI-guided click-based review required an average of 1.4-5.2 clicks depending on tissue type, with colorectal metastases detected most efficiently. Challenging subtypes, such as breast carcinoma with apocrine differentiation, required more extensive interaction. Micrometastases across all three cancer types were successfully identified by the AI.

Conclusions
The AI module improved pathologists' sensitivity in detecting LN metastases and significantly reduced review time, particularly for positive nodes. These findings support the integration of AI tools to enhance diagnostic efficiency and accuracy in routine pathology practice.