SIAPeC Case Report Award 2022 - Breast Edition

AI helps detect invasive breast carcinoma: a challenging case

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Artificial intelligence (AI) is quickly becoming a key factor in support of diagnosis and quality control in pathology. Its role is especially impactful in virtually eliminating misdiagnosis, thus allowing the best predictive ability of the histological examination. This is particularly true for breast biopsies where the tissue material is often relatively abundant and fragmented and complex lesions are frequent.

In October 2021, a 30-year-old woman underwent an MRI guided left breast biopsy of the upper quadrant due to suspicious findings at imaging. She was then diagnosed with ductal carcinoma *in situ* (DCIS). Immunohistochemistry (IHC) for p63 supported the diagnosis. The neoplastic cells were negative for estrogen receptor (ER) and progesterone receptor (PR). As the imaging was very suggestive of an invasive malignancy, a second biopsy was performed in November 2021. This time, multiple foci of high grade solid DCIS with comedo necrosis and extensive lobular cancerization were observed. Microinvasion could be neither ruled out nor confirmed. Again IHC for p63 supported the diagnosis and the neoplastic cells were negative for ER and PR.

Within the framework of AI-based quality control routinely performed in our lab, the whole slide images of the histological slides were analyzed by the Galen™ Second Read Breast application (Ibex Medical Analytics). The application raised an alert for “invasive cancer” and highlighted the areas of maximum likelihood for it to be found. Upon review, the regions were devoid of basal cells (p63 negative) and their morphology was highly suggestive of invasion. Thus the diagnosis was revised and the presence of multiple foci of *bona fide* poorly differentiated invasive breast carcinoma with apocrine features was indeed confirmed. Importantly, testing of the prognostic factors on the invasive areas showed that the neoplastic cells were negative for ER and PR but had a proliferative index (Ki67) of 50%. Furthermore, Her-2 staining was scored as 3+ (Fig.1). Thus the neoplasia could be correctly classified as belonging to the Her-2 enriched subtype.

These findings allowed for the proper therapeutic strategy to be pursued.

The present case shows how AI based systems can play a crucial role in the management of breast samples, especially in morphologically challenging cases.

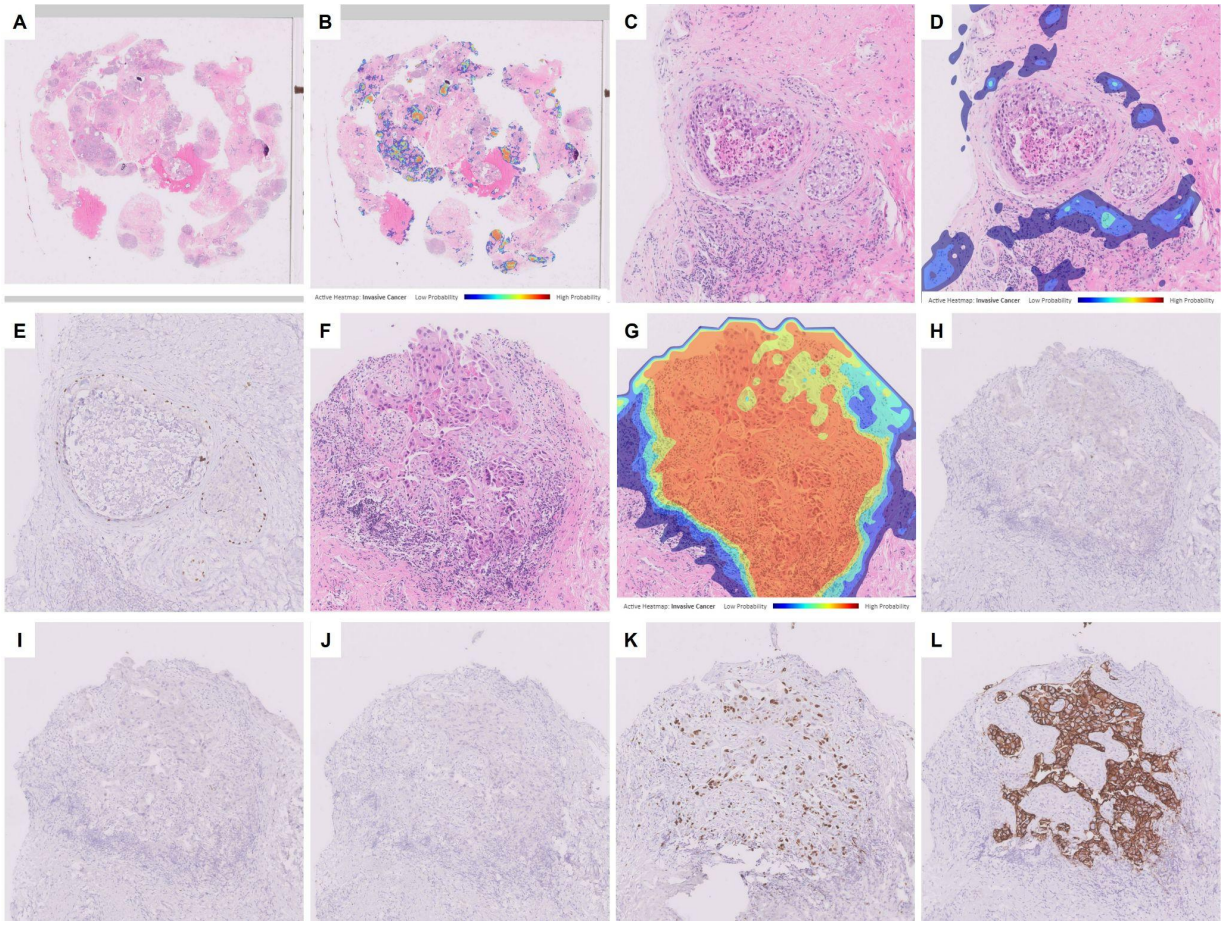

Fig.1. **A-B)** Low magnification overview; in B the “invasive cancer” heatmap* is shown (magnification 4X). **C-E)** DCIS area; in D the “invasive cancer” heatmap* is shown; the area displays p63 positive basal cells (E) (magnification 100X). **F-L)** Invasive carcinoma area; in G the “invasive cancer” heatmap is shown; the area is devoid of basal cells as highlighted by a negative p63 stain (H); the neoplastic cells are negative for ER (I) and PR (J), they have a proliferative index of 50% as shown by Ki67 stain (K) and are scored as 3+ in the HER2 stain (L) (magnification 100X).

*“Invasive cancer” heatmap: low probability is displayed in blue, high probability is displayed in red.