Initial experience with artificial intelligence-enabled multispectral imaging to identify cancerous margins in robotic-assisted radical prostatectomy

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Introduction:

MarginAssure Imaging System developed by CytoVeris uses a Multi-Spectral Tissue Auto-Fluorescence Imaging (MS-TAFI) concept and employs AI-based machine learning algorithms in tumor detection. This platform is capable of analyzing the unique "optical fingerprint" of tissue based on its intrinsic biomolecular and morphological characteristics without requiring the use of dyes or imaging agents.The system includes an imaging chamber where a surgically excised specimen is placed and imaged. The AI-generated output produced by the system displays the presence or absence of cancerous tissue.

Methods:

This is a prospective study performed from Jan 2023 to April 2023 in our center. We evaluated 511 margins from 179 patients and divided the machine learning process into two phases:

Phase 1 (training) consists of using MarginAssure to image excised prostate specimens and correlate the results with clinical data including preoperative MRI images and biopsy results as well as postoperative histopathology diagnosis to develop the data.

Phase 2 (testing) will be the validation of the device on immediately excised prostate specimens. Postoperatively, the histopathology "gold standard" will be the determinate of positive or negative margins. The imaging results will be evaluated against the pathology and the concordance between the device/algorithm and histopathology.
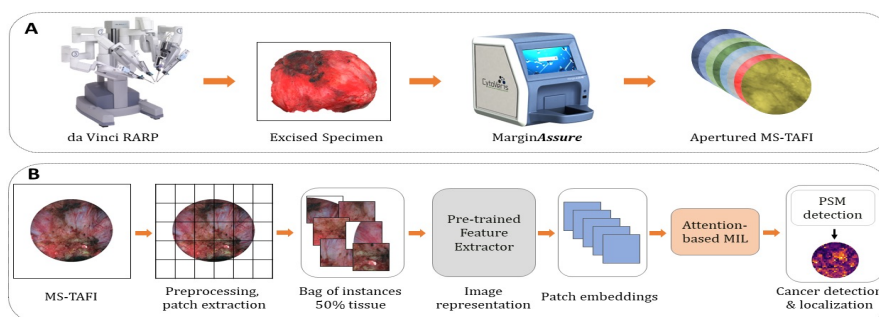
Results:

The median age 65, Median AUA 14, median SHIM 19, Overall PSM 22% and overall EPE 50%. Our analysis described 76.9% accuracy, 74.4% AUC, 76.5% specificity, and 91.6% sensitivity, 95% confidence interval is (76 +/- 0.1568). These early, initial results validate the feasibility of the approach.

Parameters	January2023to April 2023
Total number of patients	179
Age in years (Median, IQR)	65 (59 – 69)
PSA (ng/mL) (Median, IQR)	5 (3.9 – 6.8)
Preoperative SHIM (Median)	19 (16-23)
Preoperative AUA (Median, IQR)	14 (12- 17)

Table 1. Preoperative demography reporting the median value with the interquartile range, PSA, SHIM, AUA

Parameters	January 2023 to April 2023
Total number of patients	179
Pathological Stage, n, (%)	
pT2	84 (46)
≥pT3	95 (54)
Overall PSM, n, (%)	40(22)
PSM on pT2, n, (%)	12(6.4)
PSM on ≥pT3, n, (%)	28(15.6)
Overall EPE, n, (%)	90 (50)

Table 2. Pathological stage, EPE (Extraprostatic Extension), PSM (Positive Surgical Margins).

Conclusion:

Initial results showed that the MarginAssure Imaging System has the potential to differentiate between cancerous and benign tissue which may enhance the precision of tumor resection during radical prostatectomy.Next steps would include building a more comprehensive database for algorithm training/testing.