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AI-assisted detection of anal precancerous lesions to improve screening in people living with HIV

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Background:
Anal cancer occurs at disproportionately higher rates in people living with HIV(PLWH compared to the general population, driven primarily by persistent human papillomavirus infection (HPV) and immunosuppression. The ANCHOR Study demonstrated that treatment of high-grade squamous intraepithelial lesions (HSIL) reduces progression to anal cancer in high-risk populations. However, access to gold-standard risk assessment with high-resolution anoscopy (HRA) is limited and requires extensive training. We aimed to develop an artificial intelligence(AI) tool to assist HRA detection of anal lesions.

Methods:
We used 205 HRA images across 11 lesion classes. Fifteen sessions were analysed (mean age 57; 7 females and 8 males), with risk factors including HIV, smoking, and men who have sex with men (MSM). All region-level labels were created through manual annotation by specialist clinicians, with associated pathological diagnoses. Consensus or adjudication was used as determined by the study protocol. The detector was implemented using the You Only Look Once (YOLOv8) architecture, chosen to balance detection accuracy with deployability in clinical settings. Model performance was assessed using 5-fold cross-validation and an independent test set (n=30).

Results:

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The model showed strong and stable discrimination between LSIL, HSIL, and malignant lesions. Mean average precision at intersection over union 0.50 (mAP_{50}) was 93.8% (95%CI: 90.0–97.6%) in cross-validation and 95.7% (93.9–97.4%) on the independent test set. Precision was 95.1% (93.0–97.2%) and recall 89.8% (88.0–91.6%), indicating a favourable trade-off between false-positive and false-negative risk for lesion-level detection.

Conclusion:
Our preliminary data using a YOLOv8-based framework accurately detected anal lesions from HRA images and may serve as a scalable adjunct to newly developed anal cancer screening pathways. AI-assisted tools could improve access to screening and support more reliable and earlier detection & treatment of HSIL. Further prospective validation is required to assess clinical utility and integration into screening programs.

Disclosure of Interest Statement:
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