Prescreening Radiology Reports for Prostate Cancer Recurrences using a Large Language Model (LLM)

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Introduction/Background

This study evaluated the efficiency and accuracy of using the Mixtral 8x7b v0.1 Instruct LLM to prescreen radiology reports for prostate cancer recurrences post-MR-guided seminal vesicle cryoablation.

Methods/Intervention

This retrospective study included 164 patients who underwent seminal vesicle cryoablation and were followed up with either PET or MRI scans every three months until 2 years. A total of 582 radiology reports were assessed using the Mixtral 8x7b v0.1 LLM, which was not fine-tuned but provided specific details about prostate cancer and radiological report analysis. The LLM analyzed the reports for recurrence indications at the ablation site without anatomical guidance. The performance of the model was evaluated by comparing its predictions with manual assessments of the radiology reports.

Results/Outcome

The model identified 21 true positive and 498 true negative reports, alongside 63 false positive and no false negative results. The performance metrics were: PPV = 25.00%, NPV = 100.00%, sensitivity = 100.00%, and specificity = 88.77%. The use of a language model for the prescreening of radiology reports substantially enhances efficiency, processing 582 reports in approximately 4 hours.

Conclusion

This study demonstrates the potential of using an LLM for prescreening radiology reports to facilitate the detection of prostate cancer recurrences. Despite a high rate of false positives, which were largely attributed to anatomical proximity errors in token embedding, the model effectively ensured that no recurrence was missed. This emphasizes its utility as a clinical tool for enhancing radiologist awareness. Further refinement of the model's performance is necessary to reduce false positives.

Statement of Impact

The application of LLMs in prescreening radiological reports for cancer recurrence offers a significant time-saving advantage and ensures high sensitivity in clinical settings. This technology can serve as a supplementary tool to assist radiologists in managing large volumes of data, focusing on high-priority cases, improving patient care, and improving the early detection and management of cancer recurrences. This leads to timely interventions and improved patient outcomes.

Keywords

Urology; Interventional Radiology; Large Language Model; Cancer Screening