

**Title:**

ENHANCING THE DETECTION OF POUCH OF DOUGLAS OBLITERATION FOR ENDOMETRIOSIS DIAGNOSIS WITH ARTIFICIAL INTELLIGENCE, USING MAGNETIC RESONANCE IMAGING AND UNPAIRED ENDOMETRIOSIS ULTRASOUNDS

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**Background:**

When people are investigated for pelvic pain and endometriosis, they can wait 6.4 years for a diagnosis, traditionally achieved with laparoscopy. Detection of pelvic endometriosis, including Pouch of Douglas (POD) obliteration, has a 95% specificity from endometriosis ultrasound (eTVUS) and 72% from endometriosis magnetic resonance imaging (eMRI). To address this delay, IMAGENDO combines eTVUS and eMRI using Artificial Intelligence (AI). Our preliminary data has demonstrated that a novel multimodal AI approach using imaging data from eTVUS and eMRIs, improves diagnostic accuracy when detecting of POD obliteration in endometriosis.

**Aim:**

To improve eMRI detection of POD obliteration accuracy, by leveraging detection results from unpaired eTVUS data.

**Method:**

We have collected retrospective specialist private and public imaging datasets of the female pelvis. After pre-training a machine learning model using 8,984 MRIs from a public dataset, we fine-tuned the algorithm using 89 private eMRIs, to detect POD obliteration. We then introduced another 749 unpaired eTVUSs, further improving our diagnostic model.

**Results:**

Using model checking, student auditing and expert radiology review, we compensated for confounding problems with our eMRI datasets, present as a result of artefacts, mislabelling, and misreporting. These results illustrated effective multimodal analysis methods improving the POD obliteration detection accuracy from eMRI datasets. This model improved the Area Under the Curve (AUC) from 65.0% to 90.6%.

**Conclusion:**

Using a novel POD obliteration detection method, we improved the accuracy of diagnosing endometriosis from eMRIs. Our model distills knowledge from unpaired eTVUSs to enhance the automated detection of POD obliteration even if only data from eMRIs are available. Combining digital data from different imaging modalities is the first step in improving diagnosis of endometriosis and allows extrapolation of results when either imaging modality is missing. People with endometriosis will be able to obtain fast diagnosis without surgery provided specialist scanning is available.